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Agricultural Experiment Station

RESEARCH: Background For Efficient Agriculture

SIXTY-EIGHTH ANNUAL REPORT, 1954-1955

BULLETIN A-83
COLLEGE PARK, MD.
MARCH, 1956

RESEARCH: *Background For Efficient Agriculture*

UNIVERSITY OF MARYLAND
AGRICULTURAL EXPERIMENT STATION
SIXTY-EIGHTH ANNUAL REPORT

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To the Governor of Maryland, the Board of Regents, and the President of the University of Maryland

I transmit herewith the Sixty-eighth Annual Report of the University of Maryland Agricultural Experiment Station, as established by Act of Congress, March 2, 1887, containing an account of research and experiments conducted during the fiscal year ending June 30, 1955, and a statement of the receipts and disbursements for the same period.

I. C. Haut

I. C. Haut,
Director

In addition to State and federal funds, the research program of the University of Maryland Agricultural Experiment Station has received support during the year from many public, private and industrial organizations and individuals. It is regretted that space does not permit recognition of all sources of help, but the cooperation of all is herewith gratefully acknowledged.

Visitors will be welcome at all times and will be given every opportunity to inspect the work of the Agricultural Experiment Station in all its departments.

The Bulletins and Reports of the Station will be mailed free of charge to all residents of the State who request them.

Address:
AGRICULTURAL EXPERIMENT STATION
College Park, Maryland
I. C. Haut, *Director*

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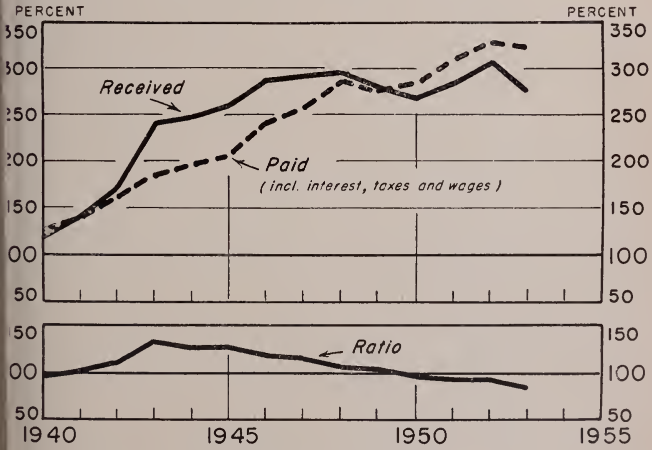
UNIVERSITY OF MARYLAND
1807 - 1856 - 1920
FATTI MASCHII PAROLE FEMINE

AGRICULTURAL ECONOMICS AND MARKETING

The objective in agricultural economics and marketing research is the application of economics to farm business and to farm family living. Research on this phase of agriculture during 1954-55 included studies in the marketing of poultry, livestock, and dairy products, production and marketing of vegetables for both the fresh and processed markets, farm prices, farm credit, rural zoning, rural transportation, farm management, farm irrigation, farm insurance and agricultural taxation.

Cost-Price Squeeze Continues

An index of prices paid by Mary-and farmers for commodities bought is the result of a recent research study. This index makes t possible to compare the prices paid by farmers in Maryland with prices received by farmers for farm products sold. The relationship between prices farmers received for their products and prices that they had to pay for commodities bought determines, to a large extent, the relative profitableness of their farming operations. Agricultural production in the aggregate is relatively stable. Therefore, changes in prices reflect rather accurately the economic situation of farmers.



Farmers' prices in Maryland.

The index of prices paid by farmers in Maryland in 1953 was 323 (1910 — 14 = 100) compared with the index of prices received of 277, resulting in a ratio of the index of prices paid to the index of prices received of 86.

(Project A-26-1)

Survey Shows Cooperative Credit Not Well Understood

Credit has become increasingly important in financing agriculture. It is used extensively for purchasing farms, equipment, machinery, livestock and farm supplies.

It is further used to expand farming operations or improve the farm homestead. Wise use of credit may make it possible for farmers to operate on a larger scale and perhaps more profitable basis than would otherwise be possible.

Farmers need to make a critical evaluation of the various sources of credit available to them in order to meet their credit needs at reasonable interest rates and on suitable terms.

Production Credit Associations and National Farm Loan Associations are an integral part of agricultural financing, but perhaps the use of these sources of credit is not as widespread as it might be; perhaps the members of these associations are not fully aware of the privileges and obligations associated with these types of credit.

Of the 384 farms surveyed, 32 percent borrowed money during the year preceding the survey; 45 percent during a 3-year period; and 52 percent during a 5-year period preceding the survey. In the 5-year period, 67 percent of the renters and 47 percent of the owners borrowed money. Of all farmers surveyed, 85 percent were not members of either a NFLA or PCA and 25 percent of this group had not heard of these associations.

Farmers who had borrowed from NFLA and PCA were generally satisfied with these associations. There appeared to be some confusion among members as to the source of money used by PCA and NFLA for loan purposes and the organizational cooperative structure of these associations.

(Project A-19-m)

Lower Auto Insurance For Farmers Justified

Results of this study indicate that farmer driver experience was considerably better than that of non-farmer drivers. This experience justifies insurance reductions on farm motor vehicles, and most insurance companies write motor vehicle insurance for farmers, or on farm motor vehicles, at reduced rates. The reduction ranges between 20 and 25 percent. A majority of farmers in Maryland are in those territories where the motor vehicle insurance rates are lowest. This fact, together with favorable occupational classification, means that most farmers obtain a given type of insurance protection at less cost than do most urban motor vehicle owners. The current trend indicates that a further classification of motor vehicle drivers based upon potential risks and driver experience for purposes of rate differentials may be forthcoming. (Project A-19-p)

Find Ways to Reduce Labor In Corn, Tomato Canneries

A current time and motion study of Maryland corn and tomato canners during the 1954 canning season shows that the critical operation in tomato canneries is at the peeling table where the daily volume is often considerably less than the capacity of other operations and processes in the plant. Similarly, but less significant, the rate of husking frequently determines the labor efficiency and sets the pace for the rest of the plant. Thus, in tomato canneries it was found that man hours per 1000 cases is deceased as the number of peelers increases, and in plants canning corn, the cutting operation may not be properly synchronized with the huskers resulting in a considerable loss of time.

Comparative process charts show that certain operating techniques require considerably less abor than others. In corn canning the following techniques required the least amount of labor: (1) In the unloading operation, corn should be pulled directly from rucks with no storage in bins or on the floor. (2) Trimmers should be located in front of huskers and should be used as their own nspectors. (3) The efficiency of cutting is increased when there is no trimming at the cutter bin. (4) Most processing operations were over-manned. Efficiency increased as the number of employees in processing operations were minimized. (5) Unscrambling should ake place on the canning line nd not as a separate operation. This should also be done as close s possible to processing, rather han at the warehouse. (6) Efficiency in casing the finished product increased when there was an orderly system of supplying cans to the operator.

Two significant time saving operations were evident in tomato canning: (1) Tomatoes should be unloaded directly to the canning operation without storage in the yard or on the platform. (2) The use of turn-tables in the pan filling and peeling operation was very effective in saving time at this critical point. (Project A-26-ao)

Study Assessment-to-Sale Ratio of Maryland Farms

Recent increases in the assessed valuation of farm property have stimulated interest in ratios of assessed value to sales price. These ratios have been used to measure the relative degree of equitableness of assessment among farms within a county and between groups of properties in different counties. This study showed that assessment-to-sale ratios for bona fide farm transfers averaged, among the counties, from 35 percent to 50 percent. An analysis of coefficients of variations indicates that farms represent a type of property that is difficult to appraise or to anticipate the value of. Results of this study clearly indicate a need for a common denominator approach in determining assessment-to-sale ratios. More intensive state supervision of farm assessing procedures would undoubtedly assist in reducing the variation in assessment to sale ratios. (Project A-19-s)

An inferior veneer log (on truck) being rejected at rail siding. A survey shows that many farmers lack adequate information on marketing of woodlot products.

Farmers Lack Information On Woodlot Marketing

A study on the marketing of Maryland forest products clearly indicates that woodlot owners lack information concerning the quantity and kind of products available for sale in their woodlots. They are also unaware of the marketing services available from public agencies. The survey shows that 139 (85%) of the 162 woodlot owners who made sales during a five year period 1947-51, had no knowledge of the amount of timber available for sale prior to making the transaction. Slightly less than half of those who had some knowledge of their saleable supply had secured the services of the professional forester, while the remainder had made a rough estimate of their own or had secured an estimate from a prospective buyer, a neighbor, a county agent or a representative of the Soil Conservation Service. More than a third of the sellers were not aware that their timber could be sold and cut according to grade, and only two-thirds had any knowledge of the management and marketing services available to them from such agencies as the United States Forest Service, the Maryland State Forest Service and the State Extension Service.

About three-fourths of the timber sales were made on the stump by verbal contract. Higher prices were generally received by woodlot operators who secured the services of state foresters and made sales transactions on the basis of written contract.

(Project A-26-ah)

Farm Irrigation Studied

Many farmers in Maryland have become interested in irrigation of farm crops as a result of several dry summers in succession. In 1954, 11,899 acres were irrigated on 188 farms in Maryland. The acreage of vegetables was the most important, accounting for 62 percent of the total acreage irrigated.

Any farmer considering the purchase of irrigation equipment should first determine if an adequate supply of water is available. In 1954, for 58 percent of the acreage irrigated, water was obtained from streams, for 36 percent, the water came from ponds, and for 6 percent of the area irrigated, the water was obtained from wells. (Project A-32-j)

Survey Shows New Trends In Poultry Product Retailing

Recently, a survey was made of 100 large independent and super market stores in three metropolitan areas of Maryland—Baltimore, Annapolis and Silver Spring. The purpose of the study was to show recent trends in the merchandising of poultry products, the problems encountered by retailers and the need for additional research on certain phases of retail store merchandising.

Results obtained from the study show that retailers are able to increase the sale of poultry products by: (1) offering a wider selection of poultry items; (2) increasing the services rendered to the housewife (such as offering ready-to-cook poultry); and (3) improving the attractiveness of the package and display of poultry items. As a means of further increasing sales, store managers indicated hat they were constantly seeking newer methods to enhance the attractiveness of their poultry displays. The greater interest on the part of retailers in the idea of merchandising eggs in window-type artons is just one example of the nthusiasm expressed.

(Project A-26-am)

Md. Snap Bean Production Declined Sharply Since '50

Snap bean production in Maryland has declined rather sharply since about 1950. Adverse price trends coupled with extreme vacillation in price have been largely responsible for the movement out of this crop into more stable and profitable enterprises, although tension arising over contracts has alienated a few growers, prompting them to abandon process bean production. Consequently, Maryland is turning to other production areas for increasing volumes of fresh market and processing beans.

An increasing number of bean growers are discovering irrigation a desirable and profitable production technique. During several of the recent dry years costs added by irrigation were much less than the increase in returns ascribable to irrigation. Yields, for example, of farms irrigating were double those of farms not using irrigation.

During the year, considerable time was devoted to studying the Baltimore Produce Market. Excessive waiting time or delays arising from congested conditions caused many local farmers to look for other outlets. The average waiting time per truck is about five hours per day, with growers and shippers sustaining the entire loss. Delays frequently create serious deterioration problems, resulting in waste and spoilage losses, a cost largely resting on consumer and farmer. Assistance was extended the Baltimore Wholesale Produce Market Commission in the hope that a new and more efficient produce market would eventually be built. (Project A-26-aq)

AGRICULTURAL EDUCATION

Research in agricultural education is primarily designed to aid teachers of vocational agriculture do their job more effectively. The projects reported on in this summary deal with two important phases of their program: how to get students into the business of farming for which the training is designed; and the equipment needed to do the best job of teaching.

In addition to using the results of research in agricultural education, teachers of vocational agriculture are major users of other new knowledge reported in this bulletin in their instruction with high school classes and with young farmer and adult farmer groups.

How Young Farmers Become Established

A total of 150 young farmers were included in this survey. They were equally divided between Charles, Frederick and Talbot Counties.

The young men had a high degree of education, with 129, or 63 percent, having finished high school and 14, or 9 percent, having some college training. The sixth grade was the lowest level of formal education of any of these men, with only one at that level. This model group averaged 11 years of schooling, until recently the end of a high school education in Maryland.

The fact that the majority went into farming directly from high school bears out the wisdom of offering vocational agriculture at that level. Of the 129 in this category over half (68, or 53 percent) studied vocational agriculture. In addition 53 indicated they would have taken vocational agriculture in high school, but it was not offered when they attended. Only 12 indicated they had no desire to take vocational agriculture in high school and five of these didn't know at that time what they wanted to do. Almost all of those who took vocational agriculture had home farming programs which helped them to eventually become established in farming. The average labor incomes from these farming programs was $445.

In addition to studying vocational agriculture in high school 54 or 36 percent, of the young men had been 4-H Club members, with the majority of these (31) being from Frederick County. The home farming programs that are part of the 4-H program likewise aided in establishment.

About one-third (53) of these farmers were veterans. This status entitled them to the G.I. educational benefits of the Institutional

On-Farm Training Program and a vast majority 44, or 83 percent of the veterans) took advantage of this opportunity.

The young farmers were asked where they had received information to help them in farming (1) before they became established and (2) after they became established. Their replies showed the following main sources of information before they became established, with the number mentioning each source being given in parentheses: Father (129), magazines (102), vocational agriculture instructor (67), neighbors (66), county agent (55), and relatives outside of the immediate family (45). The sources of information after the young men became established varied to some extent, but some of the same sources continued to be relied upon heavily by them. The main sources of information after becoming established were as follows: Magazines (100), county agent (95), fathers (66), and neighbors (65).

When the young men were asked f the local agricultural department could help them 106 (71 percent) indicated it could. By far the largest portion (77) felt the best help vocational agriculture could offer was instruction in evening classes, but a sizeable group (11) said the teacher could give them valuable advice and information, while a like number indicated the biggest help to them would be the use of the school farm shop.

(Project T-2)

Study Equipment Needs Of Agriculture Teachers

Teachers of vocational agriculture need much equipment to present their subject forcefully to their students. This equipment must be chosen hurriedly by teachers due to a crowded schedule. To save teachers time, the preparation of a comprehensive equipment list for Maryland was undertaken.

As a means of getting a start old lists used in the State were reviewed and lists were obtained from other states. From these lists a complete list was compiled. It is now being checked by Maryland teachers to see if needless equipment is listed and if any equipment that teachers find of value has been omitted. A few teachers have already used the list in its tentative form. (Project T-3)

AGRICULTURAL ENGINEERING

Agricultural engineering is concerned with the application of engineering principles and techniques to the problems of agriculture. These problems include the fields of farm power and machinery, farm structures, drainage, irrigation, rural electrification and on-the-farm processing of farm products.

More specifically, agricultural engineering deals with such problems as: reducing time and labor requirements for farm production; better housing for the farm family and the farm animals, happier and more comfortable living conditions; mechanical equipment to reduce losses of farm products by spoilage, rodents and insects; better quality of farm products by refrigeration, drying and controlled curing; and protection, by drainage and irrigation, against the hazards of unfavorable weather in the growing season.

Pneumatic Handling Of Chopped Forage

The ultimate aim of this project is to find a practical method of placing partially cured chopped hay uniformly over a hay drying system in a barn without packing the hay in spots which will cause mold.

Emphasis in the pneumatic handling of chopped forage has been placed on planning and designing the layout of equipment needed. Several pieces of special equipment will be required and some of these have been built. During the 1955 haying season an endeavor will be made to determine the velocity of air required to float

Equipment used to study more efficient ways to handle high moisture chopped hay.

chopped hay in a horizontal pipe and the mass of chopped hay a given volume of air will deliver. A study of the methods of introducing chopped hay into the air stream will be made.

(Project R-16)

Supplemental Irrigation Of Field and Truck Crops

The major emphasis has been on planning a program for irrigating tobacco, snap beans and cucumbers with variations in amount of water, frequency of irrigation, varieties, plant population and amount of fertilizer. This project is being closed this year. However, the work will be continued under a new and broader project.

(Project R-19)

Drying Shelled Corn With Unheated Air

Bins were remodeled and equipped with individual blowers so definite air volumes could be provided. Bins were filled to a depth of 6 feet with corn of 23.6 percent average moisture content. Air pressures under the bin averaged 1, 2 and 3.6 inches of water respectively for 4, 6 and 8 cubic feet of air per minute per cubic foot of corn. Drying was somewhat faster at the higher air volumes but at increased cost, due to the higher pressures required. No mold was found in bins where the blowers were operated continuously but slight mold was found in the bins under humidistat control. All but one of the bins were dried to below 15% moisture in 10 days. Humidistat control permitted drying to lower final moisture than continuous blower operation.

(Project R-17)

Tobacco Curing

Tests were continued on the use of supplemental heat and forced natural air for curing. Preliminary tests indicate that the heating system should provide at least 10 BTU's per hour per cubic foot of barn space and that the heat output should be adjustable to any point below this amount depending on requirements.

It was found that if bad weather conditions exist for more than 24 hours natural ventilation will not answer the problem, and heat should be used.

Methods to check conditions inside the barn were studied. One simple method is to wrap several bundles of cured leaves in pieces of old seed bed cloth and tie these to a cord about five feet apart. A pulley arrangement is made in each barn in such a way that these can be raised and lowered. They can then be lowered and examined to determine the conditions at different points from top to bottom of the barn. If these cured leaves remain in order for more than 24 hours, heat should be used. Good curing takes place when the temperature ranges from 70° to 100° F. and the daily average relative humidity varies between 75 to 85 percent. Humidities above 85 percent for a prolonged time will cause houseburn. When using heat, a 20° F. rise will usually be sufficient, and the temperature should never go over 100° F. For more efficient use of heat and better distribution, the barn should be closed tight. The length of time heat should be used will vary with the size of barn, weather conditions, etc.

Cured bundles of tobacco are lowered and examined to determine condition of tobacco in the top of the barn. Wickless type oil burners are used to provide heat.

When the cured leaves become dry all over the barn, the heat should be stopped. If bad weather exists, the barn should be closed. And if it continues the cured leaves should be checked. When they come back into heavy case, the heat should be started again.

An investigation was made to determine the possible effect of creosote in pressure treated creosoted posts on odors picked up by green tobacco curing and hanging in a newly constructed pole type barn. No creosote odors were detected in the tobacco after it was cured. (Project R-11-d)

Conditioning Tobacco for Stripping

Studies were made on removing tobacco from the barns for stripping during cold dry weather. Tobacco was brought to order by releasing steam at the floor leve of the barn through the use of a low pressure steam boiler. Care should be taken in releasing a smal amount of steam first at a very low pressure. This helps heat the barn up some before the full capacity of the boiler is released in the barn. Due to the large number of cracks in Maryland barns, it is recommended that a calm day be picked to steam. (Project R-11-e)

AGRONOMY

The search for better field crops and for better practices in growing these crops is never ending. The two principal lines of attack which agronomists use to improve field crop yields are: 1) plant improvement or breeding, and 2) changing the environment under which these plants grow.

Combining the best gains that can be made from plant improvement and changes in environment results in practical recommendations that improve crop production in Maryland. This is the aim of agronomic research in the State.

Conducting this research at the principal Experiment Station farms, and on outlying farms throughout the State, involves the use of small plots. Often at field days farmers ask why such small plots are used. There are several reasons for this approach. Past experience in research work has shown that the best way to overcome soil variability is to keep the plots small and to repeat each treatment three or more times. In addition to overcoming soil variability, the use of replicated small plots requires smaller areas of land, and less expediture of time and effort than would be needed with larger plots. Small plots have become the standard practice in research studies and as such are found in all of the experimental field work of the agronomy department.

The close cooperation of research agronomists and extension agronomists at the University helps to bridge the gap between small plots and actual farm practices. This is done by the use of demonstrations that show on larger areas of land the comparison of practices that appear to have a place in productive agriculture in Maryland.

In order to be sure that research work in agronomy fits the needs of the State, experiments have continued to be conducted on important soil types that are found on a number of individual farms. There has been a tendency in the past year to concentrate this outlying research at fewer locations to facilitate field days at which farm people can review the research, and to reduce the cost of conducting this work. Important centers for research are the Plant Research Farm, near College Park, the Tobacco Experimental Farm, near Upper Marlboro, the Willis Farm, near Trappe, and the Kent County Experimental Farm, near Kennedyville.

Hardy Ladino Clover Plants Found in Old Md. Pastures

Severe winter injury eliminated a large proportion of Ladino clover spaced plants during 1954-55. The greatest number of surviving plants appeared to be among plants selected originally from old pasture fields in Maryland and among some plants selected at the U. S. Regional Pasture Research Laboratory, University Park, Pennsylvania, for tolerance to low light intensities and resistance to Sclerotinia stolon and root rot. Additional selections from old pasture fields in the state are being made. (Project B-56-g)

Compare Wheat Varieties

Wheat yields were high during the 1954 harvest season in the wheat experimental program on the Plant Research Farm. The better varieties yielded from 42 to 48 bushels per acre. The new variety Seneca led the list. Seneca is very similar to Thorne but appears to be more productive and to have better grain quality. The Tayland variety continued to show a 1½ bushel yield advantage over Leapland, as well as better straw strength. Increasing quantities of Tayland, which was released last year as a new variety for Maryland farmers, are available for use in the State. (Project B-66)

Sweet Corn Rated For Processing Value

Fifty-six sweet corn hybrids were studied at the Plant Research Farm near College Park. These were selected for their value and usefulness in processing. Information was gained on the resistance

The new wheat variety, Tayland, has shown good straw strength. In field trials it equaled or surpassed the widely grown variety, Thorne, in resistance to lodging.

of these hybrids to disease, the yield of corn for canning, and the quality of the corn.

For the second consecutive year bacterial wilt was present to a high degreee, thus providing a good opportunity to determine resistance among the hybrids to this disease. Wide differences were found in this characteristic. The widely used hybrid Golden Cross Bantam again showed extensive damage from wilt. Ear worm damage was high—few hybrids had less than 90 percent infestation. An experimental hybrid from Indiana, 471-U6x81-1, bred especially for resistance to ear worms, had the lowest infestation. This hybrid had other characteristics that were not desirable, but should be helpful in introducing resistance to otherwise desirable sweet corn hybrids. (Project B-44)

New Project Begun For Hybrid Corn

Corn is Maryland's most important feed grain and silage crop. The chief purpose of a corn breeding program is to conduct a continuous search for better hybrids through breeding efforts in Maryland and through evaluation of hybrids produced at other experiment stations. In evaluating these hybrids a careful study is made of the adaptation of the hybrid in different parts of the State and the suitability of the hybrids for different cropping methods and uses.

This year a phase of the breeding work was summarized and a new project was begun to better define the work ahead. A summary of the previous work shows that data have been available each year for farmers to choose the hybrid that would best meet their needs. This has resulted in up-to-date recommendations for use throughout the State. Farmers have accepted the recommended hybrids very widely for corn production in Maryland.

Some very interesting differences have been found in response of hybrids to drought and to thickness of planting. (Project B-50)

Study Management and Fertilization of Grasses

The increased quantities of nitrogen available for fertilizer use and the somewhat lower price at which this important element is moving to Maryland farmers, has resulted in studies to determine the effect of frequency of clipping and application of varying quantities of nitrogen to grasses that are grown alone or with a legume.

In a study with tall fescue, in which this plant was grown alone and nitrated and grown in combination with ladino clover, with alfalfa, and with alfalfa plus ladino, cuttings were made at three heights and at three frequencies during the growing season. Total dry matter yields for the 1954 season ranged from 1.08 to 5.91 tons per acre. Ladino clover was maintained only when clipping was low and harvests were frequent. Alfalfa stands were reduced when cut more than three times during the season. Fescue stands were reduced when clipped at two inches or lower, except where the fescue was growing alone and received commercial nitrogen.

In another phase of this work five important forage grasses were tested for production when grown

Effect of early spring nitrogen application on grass and grass-legume combinations. Plots in the foreground are pure grass stands. Mixtures are in the rear.

alone and when grown in association with a legume. Yields were greatly increased by nitrogen application on pure grass stands. Small and unprofitable yield increases were obtained from nitrating grass-legume combinations. The application of nitrogen to grass-legume combinations largely eliminated the legumes.

The large acreage of permanent pasture in Maryland has made it important to determine the extent to which nitrogen can increase yields of long established Kentucky bluegrass-white clover sods. Studies were made to compare applications varying from 20 pounds to 400 pounds of nitrogen per acre, applied as single and as several applications during the season. Highest yields were obtained when 400 pounds of nitrogen were applied in five equal applications; however, the largest increase in yield of forage per pound of nitrogen applied was obtained when 120 pounds of nitrogen were applied in three equal applications. There was difficulty in maintaining the white clover stand in these heavily nitrated areas.

(Project B-56-o)

Seedling Management Studied with USDA

In a new study conducted in cooperation with the U.S.D.A., Agricultural Engineering Research Branch, Beltsville, Maryland, mixtures of alfalfa-brome grass, ladino clover-orchard grass, and birdsfoot trefoil-timothy were seeded alone and with a companion or nurse crop of oats. Both the areas with the companion crop of oats and the seedings that were made alone received differentia clipping treatments during the seedling year to determine the effect of clipping on competition from weeds and competition from the nurse crop, and on the establishment of the seeded species. I this first year of the study, ladin clover-orchard grass establishment was best where the areas were frequently clipped. Better stands of alfalfa-brome and trefoil-timothy were obtained with less frequent clipping.

A second phase of the seedling establishment studies was concerned with band seeding of a combination of alfalfa and smooth brome grass. In this trial, seed and fertilizer placement was varied as were the amounts of phosphorus and potash applied to the soil. This research was conducted on a soil of medium to low fertility and response was obtained when the seed was drilled and the fertilizer was banded one inch below the seed. There was an advantage for drillng the seed regardless of fertilizer placement or ratio.

(Project B-56-m)

Factors Varied in Alfalfa Test

Much of the research on effect of various treatments on crop yields s conducted as simple experiments. In the simple experiment one factor is varied while all others are held as constant as practical.

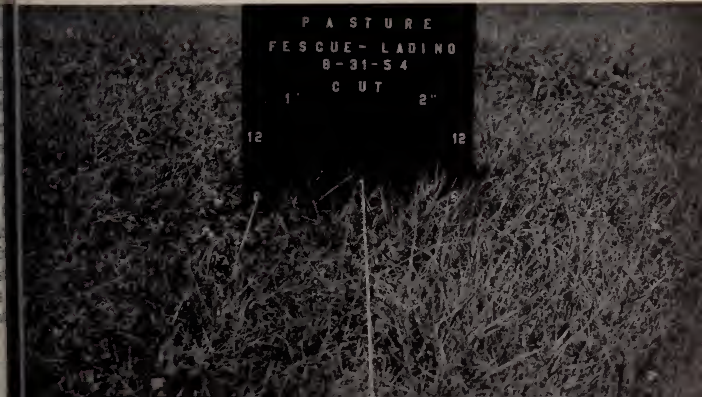
In an alfalfa study under way during the past two years, an attempt has been made to study the effect of varying several factors in the same experiment. This study includes the effect of control of weeds through the use of chemical herbicides as compared to plots in which the insects were left unchecked; using two rates of fertilization and using two varieties.

These variables are studied in all possible combinations. This allows opportunity to determine whether the advantages of the individual practices are independent or dependent on using other practices. Among those under study, the factors appear to operate independently. Main responses have been found thus far to be due to insect control, fertility level, and variety. The interaction of these factors has been small and lacking in significance. (Project B-58-c)

Summer Pasture Needed To Continue Early Gains

Grazing trials with beef cattle in Maryland have shown that the

After 2 years with four harvests per year, good ladino clover stands were maintained in association with tall fescue where the forage was clipped at 1 inch of height. Clover was largely eliminated when clipped higher or less frequently.



principal permanent and semi-permanent pasture mixtures produce most of the weight gains by mid or late July. This has emphasized the need for supplemental pastures to boost summer and early fall cattle gains. A two-year study was concluded in 1954 which compared the gains obtained during the spring and early summer from orchard grass, tall fescue, and Kentucky bluegrass, and during the summer and early fall from millet, sudan grass, and annual lespedeza.

Beef gains were similar from all of the early season pastures. In 1953 highest gains were from orchard grass, followed by Kentucky bluegrass and tall fescue. In 1954 highest gains were Kentucky bluegrass, followed by orchard grass and tall fescue. Stands of ladino clover with the orchard grass and the tall fescue were poor while a good stand of small white clover was associated with the Kentucky bluegrass.

Beef gains from the summer pastures were highest from pearl millet, followed by sudan grass and annual lespedeza in 1953. In 1954 sudan grass gave the highest production followed by pearl millet and annual lespedza.

In a new phase of the study which was conducted only during 1954, no advantage was obtained from rotationally grazing Korean lespedeza as compared to continuous grazing when the same total area was available for each animal.

These studies further demonstrated that the use of several pasture species was advantageous for adequate forage production to be maintained during the entire grazing season. Studies also clearly demonstrated that either sudan grass, pearl millet, or Korean lespedeza could be used effectively for summer grazing during the time when most of the permanent and semi-permanent pastures now used in Maryland are least productive. (Project B-56-j)

Band Seeding of Alfalfa Sometimes Beneficial

The effect of alfalfa seeding methods on weed occurrence and on successful alfalfa establishment was studied at three locations in Maryland. All seedings were made during the period August 15 to September 1. Three methods of seed and fertilizer placement, three rates of seeding, and five chemical herbicides were included in selecting a comparison. Harvest of the alfalfa plots and analysis of the information gained showed the following effects:

1. The average for all locations showed that placing alfalfa seed in rows, with fertilizer placed below the rows, was not superior to broadcasting the alfalfa and the fertilizer from the standpoint of the stands produced the first year, yields of alfalfa, or reduction of weed competition.

2. On a silt loam soil in Talbot County alfalfa seeded in rows with fertilizer in bands under the seed resulted in less weed competition than where the alfalfa was seeded in rows and the fertilizer broadcasted. On a sandy loam soil in Somerset County, these results were reversed due to fertilizer injury of the seedling alfalfa.

3. There were large differences in the kind and prevalence of weeds at the different locations of the experiment.

his precision seeder, developed by the Agricultural Engineering Research Branch, USDA, Beltsville, Md., is used to study effects of seed and fertilizer placement.

4. Equally good stands of al- lfa were obtained with 8 and 16 unds of seed per acre. Weed mpetition was similar. This was ue regardless of placement of ed and fertilizer. Four pounds of ed per acre gave lower yields d larger populations of weeds.

5. Application of chemical her- cides gave good control of weeds r the first two months after eding; however, these treat- ents also reduced the number of falfa seedlings that developed. e net result of pre-emergence rbicide use was a slight increase alfalfa yields as compared to ots that did not receive herbi- les, but these differences were t significant.

Further studies are under way determine the effect of time of eding and to further study band placement of seed and fertilizer as compared to broadcast placement of seed and fertilizer.

(Project B-58-c)

Check Accuracy of Seed Labeling

During the past two years a research program has been under way to learn more about the accuracy with which the field crop and vegetable seeds offered for sale in Maryland are labeled. This research was undertaken to form the basis of a reevaluation of the seed program in the state. It has resulted in valuable information.

Research was conducted by visiting most of the wholesale and retail seed sources in the state and selecting samples of seed for laboratory analysis to depict quality of the seed as well as the accuracy of the information on the tag. Among the various classes of seed moving to Maryland consumers the highest percentage of seed lower in quality than indicated on the tag was found in vegetable seeds. Among all kinds of seed there were enough lots of low quality to show a need for further education with wholesalers, retailers and seed consumers. The most important single cause of seed being lower in quality than labeled was improper information concerning germination.

Perhaps the outstanding finding of this research was the fact that most merchandisers of seed want to sell a product that will give good performance when grown, and that many of the poor quality samples were offered for sale because of lack of knowledge that the seed was inferior. This indicates that efforts to learn more about the reasons for seed of low quality, and ways in which seed quality can be improved will find ready acceptance among seed dealers. (Projects N-7, N-8, N-9)

Organic Matter Content Related to Aggregation

Studies of the effects of crop rotations on the physical condition of the soil are of necessity studies that occupy a given area of land for several years. In crop rotation work at the Plant Research Farm near College Park, organic matter content of the soil was found to be closely related to soil aggregation. This may mean that any cropping system or crop rotation that will increase aggregation may be expected to increase the organic matter in the soil at the same time. In these rotation studies, areas of land that were left open and kept free of weeds lost about one-third of their organic matter during a 2-year period. This would indicate that it is quite important to keep a crop growing on the land as much of the time as practical.

As has been previously reported, the rotation plots were split three years ago so that one-half of each plot could be treated with a soil conditioner and the other half left without treatment. In this third year of collection of yield data, the differences between the soil conditioner-treated plots and those that were not treated were less than in the previous two years.

Other research work concerned with soil aggregation had as a purpose the study of the effect of ammonia on soil structure. In a series of tests conducted throughout the State no destructive effec on soil aggregation was foun through the use of anhydrous ammonia. In fact on a few soils ther was an indication of possible beneficial effect from the use of anhydrous ammonia.

In a basic research study th measurement of pore size distribution of aggregates from thre soil types was made. It was foun that soil aggregate porosity wa not related to aggregate stabilit Pore space did not increase wit increasing organic matter conten although the bulky density decreased.

(Projects O-53, NE-11 and B-65

Test Phosphorus Sources

In a study begun in 1942 supe phosphate is being compared rock phosphate as a source of pho phorus for crop production. In th arly years of this experiment, hen a 2-year rotation of corn fol- wed by wheat was used, super- hosphate proved to be much more fficient than rock phosphate as ndicated by yields of the wheat nd the corn. Last year, in the 2th year of the study, with hanged fertilization to increase he amount of nitrogen and potas- ium, the yields from the rock hosphate plots came closer to the ields from the superphosphate lots. For example, with the same mount of phosphorus applied, orn yields in 1954 were 87 bushels er acre from rock phosphate, hile wheat yields were 30 bushels er acre for superphosphate and 4 bushels per acre from rock hosphate. (Project O-45-b)

earch for Better Test or Phosphorous in Soil

From 10 to 20 thousand soil amples are analyzed each year s a part of the extension pro- ram in Agronomy. One of the mportant tests is that for avail- ble phosphorus. Research studies re continuously made to improve hese tests so that they can be a ore accurate guide to the need or adding fertilizer for crop rowth. The search has centered uring the past year on a better est for phosphorus. Principal oil types occuring in Maryland ere moved to the Plant Research arm near College Park and were laced in containers with alfalfa eing grown as the test plant. The lfalfa harvested from each soil as analyzed for phosphorus. The oils were sampled at the time of arvest and phosphorus was de- ermined by several soil tests. By basing the accuracy of the soil test on a basis of alfalfa yields, and 0.21% phosphorous as a critical level in the alfalfa tissue, it was found that correlation was highest for the Truog phosphorous test, followed by the Bray test and the new test being used in arid areas involving sodium bicarbonate. (Project O-52)

Study Minerals Found In Piedmont Soils

Basic studies of the minerals found in soils of the Piedmont area of Maryland are under way to better determine the characteristics of these soils that differ in their adaptation to crop production. As has been previously reported, the sand and silt portions of the Chester soil profiles have been completely analyzed. During the past year similar analyses were made for the Elioak and Clymer soil profiles. Facilities are now being established in the soils mineralogical laboratory for a complete examination of the clay fractions of these soil profiles. The free iron oxides and cation exchange capacity of the clay portion of the soils has been determined so that this information can serve as the complete characterization of the clay minerals.

It is interesting that original classification systems in the United States have placed Maryland soils of the Piedmont area among the Gray Brown Podzolic soils. In more recent systems it has been proposed to include these soils in the Red and Yellow Podzolic soils group. From the research thus far conducted it has been found that these soils have characteristics of both these Great Soil groups. The topsoil is similar to that of the Gray Brown Podzolic soils and the subsoil is similar to that of the Red and Yellow Podzolic soils. These soils fall in a periglacial zone which is probably extensive both in the United States and in Europe. If such a zone is found to be extensive geographically, then a new Great Soil Group might be justified.

(Projects O-54 and O-48)

Study Fertilizer Rates And Ratios for Alfalfa

Sixty percent of the cultivated acreage of Maryland is devoted to the growth of grasses and legumes for forage production. Alfalfa is a high protein crop which produces higher yields per acre than most of the other legumes, when it is grown on soils to which the crop is adapted. Only 5 percent of the total cultivated acreage in Maryland is in alfalfa, although a much larger acreage is adapted to this legume. One of the important problems is to establish satisfactory ratios and rates of fertilization for efficient production of alfalfa.

The work over the past 5 years has shown that there is considerable difference in the rate of phosphorus and potash that is best for alfalfa production on the different soils that are adapted to alfalfa. For example, on a Penn soil there was marked response to increments of both phosphorus and potash, while on a deep Sassafras loam, with good previous fertilization, no differences in yield were found to fertilizer application.

A survey of alfalfa fields growing in the State showed that approximately 60 percent of the alfalfa fields were deficient in boron in July, 1954. In further study of this element, alfalfa tissue analyses for any one time were not found adequate to indicate the boron status of the alfalfa for the year. (Project O-51)

Superphosphate Aids Plant Growth 2nd Year

Results reported from previous studies showed that tobacco beds that were treated with calcium cyanamide may at times be improved by adding superphosphate to the soil, resulting in a marked increase in number of tobacco plants available from a given bed area. Further research on these same plant bed areas at the Tobacco Experimental Farm near Upper Marlboro has shown that when superphosphate was used at the rate of 1 pound per square yard for the growth of plants in 1953, there was no further advantage gained by using superphosphate for the growth of plants in 1954. Thus, there was a carryover effect of the superphosphate treatments to the second year of plant production.

Methyl bromide continued to give almost complete control of broad leaf weeds, grasses, wild garlic, and fleshy rooted perennials. Legume seeds, mostly white clover, were effectively but not completely controlled by methyl bromide. In some cases it appears that the hard seeds of these legumes survived the methyl bromide treatment and a few of these seeds produce plants in the seedbed. (Project B-59)

Tobacco seedbeds at the Tobacco Experimental Farm, showing irrigation equipment.

Study Fertilizer Rate, Placement, In Relation To Plant Population

Comparisons were continued to determine the interrelationship of fertilizer rate and placement and tobacco plant population. Throughout the study a standard 4-8-12 tobacco fertilizer was used.

In comparisons of 750 pounds of fertilizer per acre with 1500 pounds of fertilizer per acre, there was an increase of 176 pounds of tobacco per acre and an increased gross income of $79 per acre for the higher rate of fertilizer. When the rate was increased from 1500 to 2000 pounds of fertilizer per acre, a further gain of 73 pounds of tobacco and an increased gross income of $29 per acre was found.

An increase of plant population from 5000 to 7500 plants per acre increased yields by 177 pounds and gross value by $83 per acre. Further increase of plant population to 10,000 plants per acre caused a slight reduction in yield and gross value.

One important indication of the quality of Maryland tobacco is the fire holding capacity. This is measured by the number of seconds that the leaf will continue to glow after being ignited by an electric coil. It is interesting to note that fire holding capacity decreased with each increase in fertilizer rate; however, with fertilizer applied in bands along the row, fire holding capacity was 80 percent higher than with broadcast application and 38 percent higher than with row applications.

In these trials the poorest yields were in the neighborhood of 1,000 pounds per acre, while the highest yields were about 1,400 pounds per acre. (Project B-60)

Legume Cover Crops Add More N Than Previously Estimated

Averages for the past two years of the amount of nitrogen plowed down in cover crops, including top and root growth, show a range from about 42 pounds per acre of nitrogen from wheat to about 190 pounds per acre of nitrogen from vetch. From a thorough sampling of the cover crop growth above ground and in the plow depth of the soil, it became evident that vigorus growth of legumes adds more nitrogen to the soil than had been estimated from previous Maryland research.

A study of the release of this nitrogen in the soil in the form of nitrates showed that during both 1953 and 1954 nitrates were most abundant from about the middle of June until the first of July. The tobacco growing following various winter covers showed visible effects of the amount of nitrogen turned under in the cover crop. For example, the tobacco growing on land that had wheat, ryegrass, or volunteer weeds showed nitrogen deficiency symptoms, while tobacco growing on plots that contained legumes either alone or with grasses showed dark green color and more rapid growth.

Analysis of the tobacco grown following these various cover crops showed higher percentages of total nitrogen and protein nitrogen from the plots where legumes had grown as compared to those having only grass crops as a cover.

(Project B-68)

Forage Variety Tests Held at 8 Locations

Variety tests of several forage species were conducted at the Plant Research Farm near College Park, the Tobacco Experimental Farm near Upper Marlboro, and at the Willis Farm near Trappe, Maryland. Combination research-demstration trials were maintained in Kent, Garrett, Allegany, Frederick, and Worcester counties.

Williamsburg and Narragansett have continued to show superiority over other alfalfa varieties in these trials. Several late maturing experimental strains of orchard grass have proved to be productive with alfalfa for hay. An experimental hybrid of pearl millet, previously known as Hybrid No. 1, was the most productive entry in a test comparing pearl millet and sudan grass strains. This hybrid was leafier and showed less disease damage and greater aftermath growth than other entries in the test.

The Coastal strain of Bermuda grass proved to be faster growing and more productive than the Midland strain during the summer of 1954 but suffered severe winter injury in 1954 and 1955, while Midland suffered little injury in the same period.

All varieties of the annual lespedeszas were low in yield in 1954 due to dry weather.

(Project B-56-1)

Feed Grain Varieties Compared in Trials

Barley, winter oats, spring oats, and winter rye variety trials were conducted at the University of Maryland Plant Research Farm and at several outlying locations throughout the state. The outlying tests were in cooperation with the Maryland Extension Service. The Kenbar variety of barley continued to show good field performance from the standpoint of yield, quality of grain, and disease resistance. Colonial No. 2 barley, a short-awned southern variety, per-formed well in 1954. Arlington and Atlantic varieties of winter oats showed some superiority over Lee, and older variety of oats with good past performance in Maryland. Missouri O-205 spring oats, tested for the first year, appeared very promising.

Tetra Petkus rye continued to give higher yields of grain and straw than the older varieties Balbo and Abruzzi. (Project B-67)

Soybean Varieties Tested In Cooperation with USDA

In cooperation with the Soybean Section, U.S.D.A., Beltsville, variety and date of planting studies with soybeans were conducted at Beltsville and Upper Marlboro. In the research at Upper Marlboro, width of rows and rate of planting were also investigated.

The date of planting studies indicate that late varieties Dorman, Ogden and Lee must be planted as early in the summer, as soon the soil is warm enough for soybeans to germinate and grow if they are to mature before the first frost. When planted during the month of June the varieties Clark, Wabash, Perry and S100 gave better performance than Dorman, Ogden or Lee. Yields of beans decreased as rates of planting increased from 25 to 50, 75, and 100 pounds per acre. Yields of soybeans planted in rows with two feet between the rows exceeded those planted in rows with 1, 3, and 4 feet between rows. Variety tests continued to show that Clark, Perry, Wabash, Dorman, S100, Ogden, and Lee were the best varieties for bean production.

These variety tests and cultural studies have formed a basis for recommendations to Maryland farmers in order that the increasing acreage devoted to soybeans might result in higher yields. Research plots devoted to variety comparisons were also conducted at Trappe and Cambridge to aid in learning the effect of climatic and soil differences on the performance of these varieties.

The cooperative work with the Soybean Section has included the testing of new strains that may have future value in the State, and insures continued progress in soybean production.

(Project B-43)

Weed Control Research Centered on Fundamentals

Control of weeds through the use of selective herbicides is a relatively new field, both from the standpoint of use on the farm and research development. The effects of many of the selective herbicides have been so striking that their widespread use on farms has come about before there is a clear understanding of the way in which the chemical herbicide kills weeds, and the many factors that must be observed in efficient use of the herbicide.

In cooperation with weed control workers of other Northeastern Agricultural Experiment Stations, and the Weed Section of the Crops Research Branch of the U.S.D.A., work was begun to learn more about the fundamental effects of herbicides and the influence of environmental factors on the effectiveness of herbicides. Maryland studies are concerned primarily with several carbamate herbicides. Among these the most widely used is isopropyl N-(3-chlorophenyl) carbamate, known as CIPC.

The specific work of this past year was concerned with the effect of CIPC on carbohydrate metabolism and chorophyll content of corn grown under greenhouse conditions. This corn was planted in greenhouse flats and the soil surface sprayed with CIPC dissolved in acetone. Forty gallons of the solution was applied at 30 pounds per square inch pressure and was placed on the surface immediately following the planting of the corn. Flats were watered lightly after treatment. Subsequent watering was by sub-irrigation. CIPC was used at the rates of 2, 4, and 8 pounds per acre. An untreated check was included in the experiment. Ten days were allowed for germination and growth of the corn in the greenhouse. At the end of this 10-day period the growing corn was harvested by cutting the plants just below the soil line.

The level of reducing sugars, invert sugars, and total sugars was significantly higher with all rates of CIPC than was found in the untreated check. The acid hydrolyzable polysaccharides were slightly higher in the plants growing on CIPC-treated soil. No significant differences were found in the chlorophyll content of the corn.

A second phase of work was concerned with the movement of CIPC in soil. Clay loam, loam, sandy loam, and fine sandy loam soils were used. These were placed in ½ gallon size containers giving a 6-inch depth of soil. CIPC was applied to the surface at 2 and 8 pounds per acre. Immediately after application of the CIPC, the soil surface was treated with 3 rates of water equivalent to ½, 1, and 1½ inches of rainfall. After 10 days the soil was removed and separated into 4 layers—0 to ½ inch, ½ to 1 inch, 1 to 2 inches, and 2 to 3 inches of depth. The soil layers were placed under favorable conditions for germination and growth of cucumbers. The elongation of cucumber shoots was used to determine the activity of CIPC in the soil layers. With the 2-pound rate of CIPC sprayed on the surface of the soil, increasing amounts of water decreased the activity of CIPC in all soils in the first inch of depth. With the 8-pound rate of CIPC, increasing amounts of water had little effect on the CIPC in the first inch of depth. (Project B-58-d)

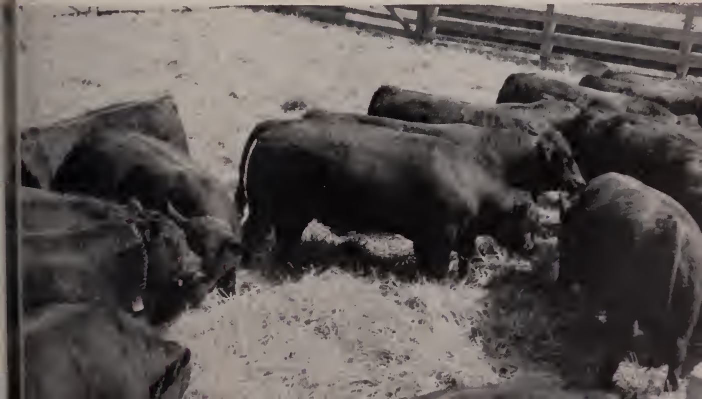
ANIMAL HUSBANDRY

Research work in animal husbandry is conducted on beef cattle, swine, and sheep. Projects, of necessity, involve the use of one or more of these species. Basic principles are usually applicable to more than one of the species. Some specific modifications may be more necessary, species-wise, in the production and management phases than in the breeding or nutritional aspects.

Research workers in animal husbandry cooperate with one another so no one project is the province of only one person. Some work is being done in cooperation with other departments within the Agricultural Experiment Station and two projects involve active cooperation with the Animal and Poultry Husbandry Research Branch of the Agricultural Research Service of the United States Department of Agriculture.

Logical shifts in immediate emphasis among the various projects have been made during the year without loss of major goals. The primary goal of research in animal husbandry is, through fundamental and applied programs, to secure knowledge which may ultimately result in more profitable operations for the producer of livestock and higher quality products for the consumer at the lowest possible cost.

'art of the first group of bulls fed for performance testing in Maryland. Fed under good practical farm conditions, some of them gained over 3 pounds per day.



Research Extended Under Farm Conditions

The cooperation of individual breeders makes it possible for research workers to test research results under good, practical Maryland farm conditions. Such cooperation by a few breeders is of untold value to the other breeders in the State because of the experience gained in the application of new knowledge.

A welcome opportunity to group-feed bull calf progenies of different sires under good, practical farm conditions was offered this year by a breeder of purebred Aberdeen-Angus cattle. Two sets of bull calves were used.

The first set was weaned, off pasture, on October 28, 1954, at which time they were weighed and conformation scores secured. The calves were kept in lots with access to an open shed and were group-fed free choice a good, farm-type growing ration until March 31, 1955, at which time they were weighed and scored again. The calves were in good condition at the start and end of the trial so the gains do not include a shift from thin to good condition.

The age at start of the first set (27 head) ranged from 178 to 290 days, averaged 227 days (standard deviation, 26 days); the weight at the start ranged from 405 to 630 pounds, averaged 511 pounds (standard deviation 57 pounds). At the end of the 154 day feeding trial the weights ranged from 790 to 1090 pounds, averaged 913 pounds (standard deviation 66 pounds). The average gain per day of the calves ranged from 2.1 to 3.1 pounds. Nine gained at the rate of 2.75 pounds per day or faster, 11 gained between 2.5 and 2.75 pounds, and five of the remaining seven gained over 2.25 pounds per day.

Twenty-five other calves were weaned during December, 1954 and up to January 17, 1955. These were placed on test January 28, 1955 and fed for 62 days; the conditions being the same as previously mentioned. The range, average and standard deviation for age at the start were 153 to 309, 222 (26) days respectively; the figures for the beginning and final weights were: 330 to 625, 447, (77) pounds and 500 to 790, 610 (79) pounds respectively. Rate of gain per day varied from 1.94 to 3.06 pounds. Of the 25 calves, nine gained over 2.75 pounds per day, eight gained from 2.5 to 2.75 pounds and of the eight others, six gained at least 2.25 pounds per day.

A number of items of practical importance were found. With comparatively little time and expense it is practical to group-feed bull calves under Maryland conditions. The use of a sound growing ration permitted the calves to arrange themselves as far as gaining ability was concerned and the ration used permitted bulls to grow rapidly and attain weights well over 900 pounds when one year of age.

The time of weaning, housing, rations, etc., was determined by the cooperator. One practical change in procedure could be to allot the calves more nearly to an age (or weight) at weaning as some of the calves of the second group were of similar weights and ages of the first group at the October date.

fficient arrangement for weighing and scoring. Cattle are weighed on scale in ackground, and turned into small holding pen for scoring. With this arrangement and an adequate crew, weighing and scoring takes about 2 minutes per animal.

Additional information of much ractical application was also seured. The correlations between itial age and weight with gain uring the trials were, in general, ear zero and none were of any redictive value. The correlations mong the scores of different dges fell in the range of 0.6 to 75 which is about the same as reviously secured in other studies. udges apparently shifted their oring scales from one time to other which indicates one weakss of scoring which seemingly potentially ever-present. The rrelations between scores at the art and the gain during the trials ere near zero and of no predictive lue. Scoring different parts of e body separately added nothing to the correlations between score at the start and gain during the period. It appears that if a person wishes to find out the rate of gain of his calves, he has to conduct a feeding trial, because little, if anything else, used in this study was of value in predicting rate of gain.

Further cooperation is being planned with this breeder in order to capitalize on the experience gained to date and to study further the problems that arise in the field. This cooperative study may be a milestone in the breeding and selection of beef cattle in Maryland as it is the first such trial known to be conducted.

(Projects C-14 and C-14-b)

New Project to Study Beef Evaluation Methods

Work on the development of possible new techniques for the evaluations of rate and economy of gain in beef cattle is being extended through a new project. The Aberdeen-Angus and Hereford steers and heifers of the University's herds will be divided at weaning time so that one-half of each group will be group-fed and one-half will be fed individually. Studies will be made of the group vs. individually fed calves as a technique for sire testing. Conformation scores and a variety of measurements will be taken in a search for ways to forecast rate and/or economy of gain. (Project C-14-d)

Study of Measurements Of Steers Completed

The study of the relationships among measurements taken on live beef steers, among the weights of the wholesale cuts, and among measurements of live steers and the weights of wholesale cuts has been completed. The essential information from the project has been given in previous annual reports. It appears that the results of this study indicate the need for extensive work on the evaluation of presently used judging criteria and practices and that the use of measurements may have great potentials as far as the selection of beef cattle are concerned. The measurements taken on the individually fed calves under Project C-14-a and accumulated under this C-14-c project during the past two years will be transferred to project C-14-a for further study.

(Project C-14-c)

Techniques Being Improved For Rumen Studies in Bloat

Studies on bloat in ruminants are being conducted in cooperation with the University's Departments of Dairy Husbandry and Bacteriology and with the Animal and Poultry Husbandry Research Branch, Agricultural Research Service, U.S.D.A. Emphasis has been given to the study of bacterial action in the rumen in an effort to determine if there are any significant differences in rumen metabolism between normal and bloating animals.

During the past year, studies have been conducted to develop improved techniques for the determination and critical evaluation of chemical reactions taking place in mixed suspensions of rumen bacteria. It has been found that a large percentage of the volatile fatty acids recovered in glucose dissimilation tests with unwashed cell suspensions was already present in the suspensions as prepared, and that another fraction was produced from endogenous substrates in the cells. Endogenous substrates and metabolic end products in the suspensions have interferred with specific tests for enzyme systems concerned in the metabolism of glucose, maltose and several amino acids. Results to date have also pointed out the necessity for improved and accurate methods of estimating the bacterial concentrations used in metabolism studies.

Repeated washings, incubation and washing, and lyophilization of the bacterial suspensions have been tried in an effort to reduce or eliminate the difficulties arising om large amounts of exogenous nd endogenous materials. Wash-ig three or four times will re-iove 85 to 95 percent of the vola-le fatty acids present in the sus-ension, and incubation without dded substrate, followed by wash-ig, will materially reduce the mounts of both exogenous and ndogenous fatty acids.

Lyophilization will remove the latile acids and will give a prepa-tion that retains appreciable en-matic activity for at least thirty ys. Dissimilation tests with glu-se using washed, incubated and ashed and lyophilized rumen bac-ria indicate that the production volatile fatty acids is compar-le to that found in tests with nwashed suspensions. The nounts recovered should give a ore accurate estimation of the tual volatile acid production om an added substrate than can obtained when exogenous and dogenous acids interfere. More data is needed to determine the feasibility of these techniques and especially to see if the results give a true picture of metabolism in the intact ruminant. Studies now under way will give more information in the near future.

(Project GC-45)

Maryland No. 1 Breed Data Analyzed in Detail

The last litters of Maryland No. 1 pigs to be raised under the present project were farrowed in the spring and fall of 1954. The breed will be continued as a part of new projects which are being instigated at the present time.

The data collected from these pigs has been analyzed in detail during the past year. A number of final analyses are being made at the present time but final results are not now presentable. A second publication is planned to summarize this past year's work.

(Project C-20)

aryland No. 1 gilt, 3887, at 14 months of age—trim, long bodied, well fleshed meat type with a well rounded ham. This gilt is very uniform in depth and width.

ANIMAL PATHOLOGY

The Department of Animal Pathology is associated with the Live Stock Sanitary Service of the Maryland State Board of Agriculture. The departmental activities are concerned entirely with research studies on diseases of animals and poultry. Staff members devote time to diagnostic work with the Live Stock Sanitary Service and with teaching in the College of Agriculture.

The departmental headquarters are at the Live Stock Sanitary Service Laboratory at College Park. Some studies are conducted at the branch laboratory at Salisbury. These laboratories are equipped with the usual apparatus needed for research. In addition, there is an electron microscope, an ultracentrifuge, and an electrophoresis apparatus for virus studies. Appropriate apparatus is also furnished for studies of bacterial activities and for chemical determinations.

Progress in Measurement Of Brucellosis Resistance

Research workers in the field of brucellosis have long been confronted with two problems regarding the effectiveness of calfhood vaccination. The age at which calves should be vaccinated to produce the most effective resistance to the disease without causing persistent titers still is a subject of some controversy. There are also conflicting ideas of various research laboratories concerning the duration of the immunity produced by vaccination. Some workers believe it is life-long, while others feel it lasts for only a few years at best. There is data available to support all of these ideas. Since further information would help solve these problems, a test to measure the protective substances in the blood of cattle was devised.

During the past year considerable progress has been made on the measurement of the resistance of cattle to brucellosis, using embryonating eggs. When infected with 75 *Brucella abortus* organisms of a certain strain, seven-day embryonating eggs die with great regularity in three days. Prolongation of life of the treated eggs beyond this period indicates that the blood serum has some protective quality. Sera from some animals may protect the embryonating eggs to such an extent that they will continue to develop and hatch into healthy chicks. Other sera may increase the embryonic life for only a day or two beyond that of the controls. Gradations of all types are to be found between these extremes, and it i hoped that a technique may b developed to check accurately th protective quality of the bloo serum of any animal.

The sera of cattle show a very vide range of variation in their rotective qualities, depending on ge, vaccination status, environnent, and individual characterisics. The serum of unvaccinated nimals, which have been in acredited herds since birth, gives elatively little protection to inected embryonating eggs. Howver, vaccinated animals of all ages n such herds showed a much reater ability to protect, since 30 ercent of the infected eggs atched when injected with serum rom these animals. In non-acredited herds, 31 percent of the era from vaccinated animals and 2 percent of the non-vaccinates rotected the eggs so as to allow atching.

When vaccinated at six months age and checked frequently for ne development of protective odies, calves showed that blood erum obtained before calfhood accination protected the embryoating egg to some extent. Blood otained two weeks following vacnation gave somewhat less proction, but the resistance to brullosis apparently increased with e succeeding weeks. Inoculation eggs with serum from these lves three months after vacnation allowed 16 per cent of e eggs to hatch.

The work on small dose vacciation and revaccination, which s been carried on by this laborary for a number of years, is being ought to a close because of the ucellosis eradication program. ne use of live vaccine in adult imals is not compatible with the sting program now in use. It has en reported earlier that smallse vaccination appears to be effective in preventing the spread of brucellosis in newly infected herds without producing lasting blood titers which interfere with the diagnosis of the disease. It has also been observed that revaccination with small booster shots produces only transient blood reactions in most animals.

(Project D-46)

New Drugs Tested For Blackhead Treatment

Investigational work with Blackhead (infectious enterohepatitis) of turkeys and chickens is being directed toward the solution of troublesome phases of the problem. Of first importance, at the present time, is the development of new drugs that can be employed alternately with those now in common use. Although much has been accomplished in prevention, this malady continues to menace the industry. Blackhead causes most serious losses in partly grown turkeys. The disease is caused by a small, single-cell parasite that is voided in the droppings of affected birds. This parasite is able to survive in soil for many months, when it becomes incorporated in the egg of the cecal worm. The principal symptoms of blackhead are a dark-colored head and sulfur-colored droppings. During recent years, the death loss in growing turkeys over the nation has been reduced to a marked extent. Drugs effective in blackhead prevention have contributed to improved economy of turkey raising.

Although drugs are effective in preventing losses from this disease, some forms of treatment depress growth of the turkey to a certain extent. There is particular need, at the present time, for somewhat milder forms of treatment. Recently, a drug known as NF-180, or Furoxone, has been employed against blackhead. This drug is free from depressing effects exerted by some forms of treatment. At the same time, it promises to prevent symptoms of blackhead from appearing in the flock. Still other related drugs are under investigation, and it is believed that further improvement in treatment of this disease will be made. (Project D-55)

Oral Treatment of Ketosis Found to be Effective

The basic studies of ruminant metabolism, which are necessary for the understanding of nutritional and metabolic disorders, are being continued. An immediate practical result of these studies has been the development of a treatment for ketosis with propylene glycol given by mouth. This treatment is economical and effective. The most significant thing about it, however, is that it demonstrates that ketosis can be cured by food substances given orally. This finding indicates that a nutritional means may be found for preventing the disorder. (Project D-53)

Newcastle Infectious For Animal Species

Continued studies indicate that the virus of Newcastle disease is capable of establishing itself in animal species. In addition to hamsters, monkeys, cattle, and Swiss albino mice, it is now shown that kittens and rabbits can be infected. This tendency of the virus to change its disease-producing properties makes it important, as far as health is concerned, and also furnishes a basis for many studies of virus characteristics.

The virus of infectious bronchitis of fowls was not transmitted to Swiss albino mice by several routes of inoculation. In a trial with a limited number of monkeys, bronchitis virus produced a respiratory condition in one monkey, but the test was inconclusive and further work must be done.

(Project D-52)

Anaplasmosis Survey To Locate Carriers

Anaplasmosis continues to be one of the major diseases of cattle in Maryland. Numerous requests for assistance in the diagnosis and control of this malady are received at the Live Stock Sanitary Service from veterinarians and cattle owners.

Through use of the complement-fixation test, it has been found that some herds in Maryland have carrier animals whose blood is infectious for susceptible cattle. In order to obtain more information on the extent and location of herds infected with anaplasmosis, a survey is being conducted by applying the complement-fixation test to blood samples from a large number of cattle in all counties of the State.

Blood-sucking insects play an important part in the transmission of this disease. Eradication of carrier animals and intensified insect control measures are necessary to prevent spread of anaplasmosis. (Project D-50)

OTANY

The Department of Botany is involved in research, teaching, and extension. Each of these fields stimulates and augments the others.

Contact with the growers suggests new problems on which research is needed. The new discoveries from that research find their way into scientific and popular journals, into the various courses offered in the department, and are brought to bear on the solution of problems in the field.

Certain of the research projects do not originate by way of a field problem but, rather, are deemed desirable areas of exploration by a certain investigator or team of investigators. The results from these projects increase the store of fundamental knowledge of such areas as nutrition, plant breeding, disease control, etc., and, in most cases, practical applications are soon made. Thus certain of the projects in the Department of Botany are directed toward the solution of immediate field problems, while others are designed to increase our store of fundamental knowledge which ultimately is the basis for the solution of all field problems.

ntinue Development f Disease-Resistant d. Tobacco Varieties

Previous work by the Agronomy
partment has indicated that va-
ties of tobacco with character-
ics similar to Maryland type 32
ve resistance to mosaic, wildfire,
d black root rot in the same
nt.

Another variety developed by
nt pathologists in the Botany
partment has a high degree of
istance to black shank. In the
t few years these varieties will
grown in the five tobacco coun-
s of Maryland under different
wing conditions to determine
d performance.

urther work has been carried on in developing two new varieties now in the third generation, one of which shows resistance to black shank, Granville wilt, and black root rot. The other variety shows resistance to black shank, Granville wilt, and fusarium wilt. In 1955 small plot field trials of resistant selections grown in presence of black shank and Granville wilt indicate some selections have appearances similar to Maryland type 32 in field. The best of these selections will be further indexed for disease resistance to the above diseases in the greenhouse during the winter.

Greenhouse tests have shown that some nicotianae species are resistant to tobacco anthracnose. One of these species *Nicotiana sylves-*

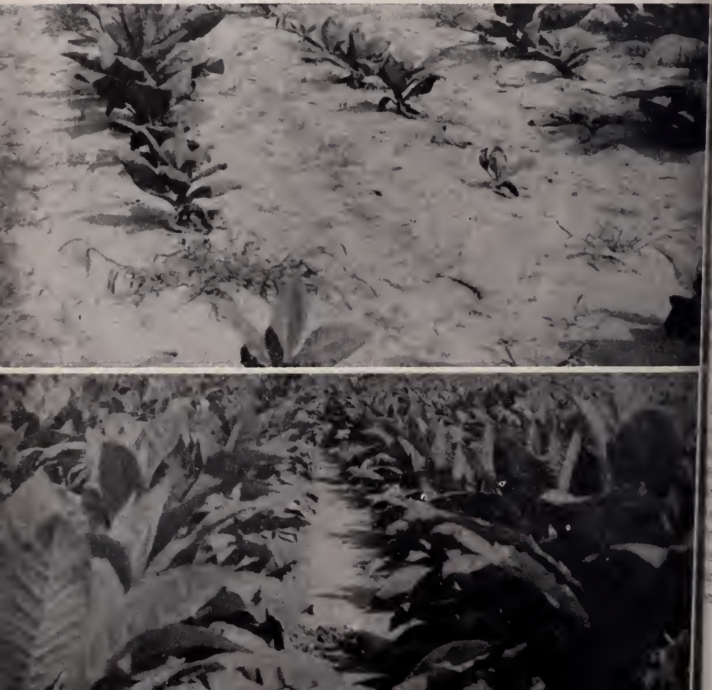
tris has been crossed on Maryland Catterton and Robinson varieties of tobacco to introduce the resistance into Maryland tobacco. These crosses will be indexed for resistance to anthracnose in the greenhouse during the winter of 1955.

(Project J-95)

Develop New Methods For Soil Fumigation

New soil fumigants are being developed for the control of root-knot nematode. A few of the new chemicals control some of the soil-borne fungus pathogens as well as nematodes. New methods of application have been devised which will enable the farmer to use his fertilizer spreader and other equipment to apply the fumigant to the soil.

One of the new chemicals was used in two tests on tobacco in 1955. The fumigant used was a chemical impregnated on an inert granular material. The fumigant was applied to the soil with a fertilizer spreader in one test and by hand in another. Both methods tried gave excellent results.



Top: Tobacco damaged by root knot nematode, 1954. Bottom. Same area after treatment with new nematocide spread by fertilizer spreader and plowed under in 1955.

The fumigant was applied to he surface of dry land (wet soil, ew, or rain liberates fumigant), hen immediately plowed under. 'his was done three weeks before lanting. No phytotoxic effects ere noticed in the tobacco plants. 'his fumigant has been found to e effective against nematodes in ruck crops.

Tests in 1954 using ethylene ibromide on five different crops—antaloupe, pepper, tomato, tobaco, and sweet potato—indicated hat growers could more than doule their yield by soil treatment or the control of nematodes.

Other tests on tobacco with D-D nd ethylene dibromide in fields nfested with nematode and fusarum wilt fungus showed that fuarium wilt could be controlled by estroying nematodes. There were ve times as many plants with usarium wilt in untreated plots s in treated plots.

Further tests for the control of her soil-borne pathogens have hown that the bacteria causing ranville wilt of tobacco can be fectively controlled by plowing nd disking infested soil every ree weeks during the summer llowing treatment of soil with 00 pounds of hydrated lime per re. Nearly perfect control was tained with this treatment in a acre field.

Experimental tests in the greenuse for chemical control of the ngus causing black shank indites that the fungus is controlled ore easily in light, sandy tobac soil than in soil high in humus. urther tests on the control of ack shank by treating soil with ngicides indicate that a few emicals are effective.

(Project J-93)

Field and Lab Studies Help Clarify Nematode Problem

Estimates of loss due to nematodes are extremely difficult to make because nematodes seldom kill plants and losses caused by them are usually expressed in lower yields and reduced growth.

Work in progress is designed to determine the extent of the nematode problem in Maryland. Soil and root samples have been collected from over 800 fields and examined for nematodes. To date, over 35 different genera of plant-parasitic forms have been found. Information is accumulating on soil-type preferences, host ranges, and other environmental requirements of these animals.

Greenhouse and laboratory work is under way on two of the more important types found in this state. Detailed host ranges, temperature effects, and feeding habits are being investigated in the genus *Trichodorus*, the stubby-root nematode. *Pratylenchus spp.*, the meadow nematodes, show considerable variation in form. These variations are being examined to help clarify the species concept in this group of parasites.

(Project J-96)

Cytology Aids Evaluation Of Plant Relationships

For many years, species were separated by differences in the structure of plant parts. More recently, the science of cytology has assumed an important role in evaluating relationships in plants. It is now recognized that differences or similarities in the number and structure of the carriers of heredity, the chromosomes, must be considered in determining taxonomic relationships in addition to the details of external plant structure.

During the past year, chromosomal studies in the genus *Sorghum* showed that *S. vulgare, S. arundinaceum, S. verticilliflorum* and *S. drummondii* are much more closely related than had been believed previously from studies of plant structure. Each of the four species has twenty chromosomes. Regular pairing and normal separation of the chromosomes in the pollen mother cells of the interspecific hybrids show that major differences in chromosome structure are not present in these species. A taxonomic revision seems advisable in consideration of these results.

Chromosomal associations were determined in a hybrid of *S. vulgare* and *S. halepense*. A comparable study was made in a hybrid of *S. vulgare* and *S. almum*. *S. vulgare* has twenty chromosomes; forty chromosomes are present in the cells of the other two species. Studies of the chromosomal associations in the hybrids disclosed that the chromosomes of *S. vulgare* are in part similar to those of *S. halepense* and *S. almum*.

(Project F-16)

Study Multiple Seedlings Caused by X-Ray Treatment

Our previous studies have shown that twin, triplet and quadruplet seedlings occur naturally in the garden pepper. More recently, we have induced multiple seedlings in corn and lilies by X-ray treatment of the pollen. Much of our research during the past year has been concentrated on determining the reasons for the formation of multiple seedlings following X-ray treatment of the pollen. Our recent results suggest that X-ray-induced losses of portions of the chromosomes are concerned in the formation of multiple seedlings. A study of the successive phases of embryo development following the X-ray treatments is now in progress.

Some of the members of multiple seedlings are haploids and have a single set of chromosomes derived from the female parent. A haploid plant is highly sterile but treatment with the alkaloid colchicine results in fertility by doubling the single set of chromosomes of the haploid. Self-pollination of the doubled haploid produces a true breeding line free from genetic variation. Doubled haploids have been used as the basis of our pepper breeding program. Twenty-eight experimental lines of peppers are being tested during 1955 in a field planting at Hurlock. This research is directed towards obtaining improvements in fruit quality and yield. (Project F-15-b)

Boron Aids Sugar Movement And Transportation of Plants

Using normal and boron-deficien plants, a single intact leaf of eac type of plant was exposed to radioactive CO$_2$ for a brief period o photosynthesis and translocation Following this interval and a separation of the plants into variou fractions, it was found that muc more of the manufactured "sugar was translocated by normal tha by boron-deficient plants.

In other studies, the rate o transpiration was found to be les for boron-deficient than for norma plants. Leaves of boron-deficien plants were found to have a highe concentration of hydratable co

loids (pentosans and pectic substances) than did the leaves of normal plants. In addition a very high percentage of the stomata on the leaves of boron-deficient plants have only one guard cell and, consequently, appeared to be nonfunctional in transpiration.
(Project K-8-c)

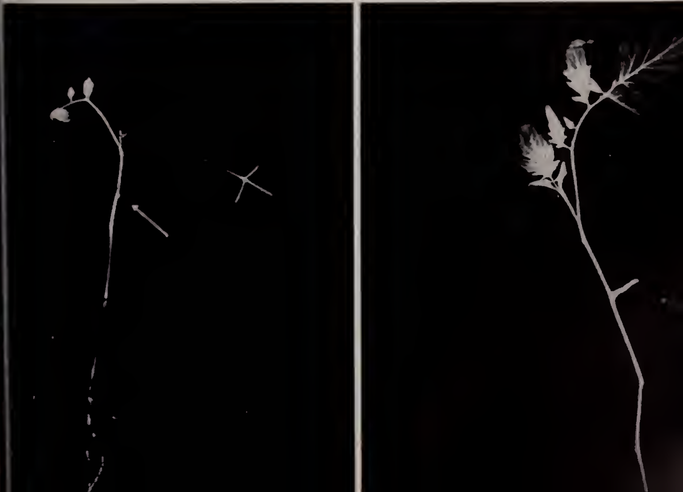
Find Soil Organism Retards Fungus Growth

An organism, found in Maryland soil, is antagonistic to many fungi which cause plant disease. When grown together in pure culture, this organism retards growth of the Dutch elm fungus, most wood-decay fungi, some damping-off fungi, the sweetpotato black rot fungus, etc. However, there was no adverse effect on growth of bacteria. Preliminary studies on the nature of the active principle show that it is moderately heat stable; slightly soluble in ether; insoluble in chloroform; and of relatively small molecular size. (Project J-92)

Seek Sweet Potato Stock Resistant to Black Rot

In order to find resistance to the black rot disease about 125 different lots of sweet potatoes were artificially inoculated. The original material had recently been obtained in the Caribbean area by the United States Department of Agriculture. Roots of each of these lots were inoculated with an isolate of the black rot fungus from Maryland and with one from Louisiana. It was found that nearly all were very susceptible but three of the introduction numbers were found to have considerable resistance to black rot of the storage roots.
(Project J-86-a)

By containing radioactive sugar, dried plants in contact with X-ray film "take their own picture" and show that more sugar was moved from the treated leaf of a boron-supplied tomato plant than from that of a boron-deficient plant. Arrows indicate point of attachment of leaf which was exposed to radioactive CO_2.



DAIRY

Research investigations conducted by the Dairy Department staff have been divided into two major phases, dealing with dairy production and dairy manufacturing problems. In dairy production, the problems receiving major attention were health (ketosis and bloat); nutrition, with special emphasis on how the cow uses her feeds; and basic physiological studies dealing with milk secretion. In dairy manufacturing, or dairy technology, studies have been made concerning problems in processing that cause off-flavor in market milk and brown color in evaporated milk.

Studies were continued on the detection of substitute fats in dairy products, testing for total solids in milk, and the use of farm holding tanks in storing milk. Studies were initiated dealing with high-temperature pasteurization of ice cream mix, and the marketing of milk through vending machine.

New Substances Effective In Treatment of Ketosis

During recent years, dairy scientists at the University of Maryland have discovered that cortisone and cortisone-like substances produce more rapid recovery of cows with ketosis (acetonemia) than any other known treatment. During the past year, several new cortisone-like substances have been found to be more effective than cortisone for the treatment of ketosis. In addition, lactate, which is commercially produced from milk sugar, has been found to be as effective as sodium propionate, and far more palatable. A total of 227 cows with ketosis have been treated with various substances during the past year. It was established that even the most difficult cases will recover rapidly when a sufficient amount of the cortisone-like substance is used. The most effective cortisone-like substance studied was 9-alpha-flurohydrocortisone (Fludrocortisone), being approximately fifteen times more potent than cortisone Only 50-150 mg. were required t produce recovery as compared t the recommended dosage of 150 mg. of cortisone. Meticortandraci (Meticorten) was found to be ap proximately four times more poten than cortisone, an adequate dos being from 300-500 mg. Hydrocor tisone was found to be about 5 per cent more potent than corti sone, 1 g. (100 mg.) being adequat in most cases. Even the most diff cult cases recovered rather prompt ly when 2-2.5 g. were administere over a two-day period. Doses large than this are not recommended be cause of the depressing effect o milk production, which has bee observed at levels greater tha 2.5 g. These data establish a stan ard on the basis of which all oth cortisone-like materials can be evaluated.

Combinations of calcium and sodium lactate were found to be effective for the treatment of ketosis, being especially good as a supportive treatment following the use of one of the cortisone-like substances. Lactate was found to be similar to propionate in effectiveness and to have the advantage of being far more palatable.

Previous studies here established that the quantity of volatile acids in the rumen of cows with ketosis was low. However, it was also shown that low levels of these volatile acids were also apparent n cows which had gone "off feed", therefore, making it impossible to determine whether low volatile acids were the cause of ketosis, or merely produced by the fasting usually associated with ketosis. Studies this past year have shown that cows with ketosis, who still maintained normal appetites, exhibited normal to high levels of rumen volatile acids, thus showing that a deficiency of these acids is not the cause of ketosis.

(Project G-37)

Growth Hormone Injected Before Calving Increases Heifers' Milk Production

Two sets of identical twin heifers have now completed their first lactation following the injection f growth hormone into one animal of each pair immeditely prior to calving. The use of this new, ighly purified hormone resulted in an increase in total milk produc-on of over 20 percent during the ntire lactation period. This increase in milk production was obtained without any increase in feed intake or change in body weight, thus showing that the increase in milk production was due to a marked increase in efficiency of the conversion of feed into milk.

It has been established that the injection must be made prior to parturition to obtain a lasting effect during the entire lactation period. In a study with 6 first-calf heifers, which received growth hormone following calving, it was observed that, while a marked increase in milk production occurred following the injection of growth hormone over a period of two weeks, the level of production returned to normal within a few days after the hormone injections were discontinued.

A study with one set of mature identical twin cows was conducted, in which one of the cows received growth hormone injections prior to calving. No lasting effect was observed in this case during the following lactation period.

It is concluded that a lasting effect is obtained only on first-calf heifers which are injected with growth hormone prior to calving. This suggests that the effect is one of increasing the growth of the udder so that it produces approximately its mature equivalent during the first lactation period. The results to date indicate that the injection of growth hormone into first-calf heifers prior to calving may prove to be a practical method of increasing total milk production, as well as the efficiency of milk production.

The heart-lung apparatus (mechanical cow) for the perfusion of the excised udder of the cow has been modified and improved so as to permit a study of the effect of blood pressure and the rate of blood flow in the udder on the secretion of milk. The modification included an all gas-type apparatus for the use of radioactive substances in studies on how milk is made. (Project G-38)

Progress Made In Study Of Role of Rumen Bacteria

The incubation of rumen bacteria with a large amount of various carbohydrates has shown that these bacteria store relatively large amounts of starch when an abundance of carbohydrate is available. The storage of starch within the rumen bacteria may become so great that the bacteria will more than double in size. This starch becomes available for the rumen bacteria when other sources of energy have been used up, it is converted to volatile acids, which are absorbed through the walls of the rumen as the principal source of energy for the animal.

Lactic acid is also produced by the rumen bacteria when carbohydrate substances are present in large amounts. The large amounts of lactic acid were produced when the pH of the rumen contents was neither higher or lower than normal. It was also demonstrated that aureomycin and terramycin inhibited the utilization of a number of pure carbohydrates, indicating that the metabolism of rumen bacteria may be altered by the feeding of antibiotics. Lactic acid in the form of calcium and sodium lactate, when fed to cows, was absorbed rapidly from the rumen and appeared in the blood as lacti

A veterinarian making a rumen fistula for studying digestion in dairy cattle.

acid, being available as an important source of blood sugar. Appreciable progress is being made in these fundamental studies on the role of rumen microorganisms in the nutrition of the cow, in which the ultimate objective is to control the activity of rumen microorganisms in such a way as to increase the nutritive value of various feedstuffs, and to ascertain whether various digestive abnormalities in the cow are due to alteration of the metabolism of rumen microorganisms. (Project G-39)

Rumen Bacteria May Play Important Role in Bloat

Material removed from the rumen of cattle on bloat-producing rations was observed to undergo a rapid increase in volume, with the formation and trapping of numerous small bubbles of gas. This frothiness was very stable and appeared to be an important factor in bloat.

Extensive studies have been conducted during the past year on the nature of the rumen material of bloated animals, the possible relationship of the metabolism of rumen microorganisms to the development of bloat, and the type of microorganism present during the development of bloat. Marked differences were observed in the amounts of the various volatile fatty acids in the rumen of cattle on bloat-producing rations as compared with cattle on normal rations.

Bacteria removed from the rumen of animals on a bloat-producing ration exhibited an alteration in metabolism as contrasted to the rumen bacteria from animals on a normal ration. A large increase was also observed in the number of capsulated bacteria in the rumen of cattle with frothy bloat, indicating that the slimy character of the rumen contents may be due to the presence of these capsulated bacteria. Thus, for the first time, there is an indication that rumen microorganisms may play an important role in the development of bloat.

These studies are being carried out cooperatively by the Dairy, Bacteriology, and Animal Husbandry Departments at the University of Maryland, and the Bureau of Animal Industry at the U. S. Department of Agriculture Research Center at Beltsville. (Project G-45)

Higher Protein Feeding Increases Amounts of Fatty Acids in Rumen

Acetic, propionic and butyric acids, which are by-products of bacterial activity in the paunch of dairy cattle, supply a major portion of the nutrients available for milk production. A knowledge of factors influencing the supplies of these materials is essential if we are to feed for most efficient production. Studies recently concluded indicate that feeding protein at higher than normal levels will increase the total amounts of these acids present in the rumen. There was a greater increase in propionic and butyric acid content than for acetic. Additional work is needed before any changes in practical feeding recommendations can be made. Studies are planned on the effect of various levels of these acids in the rumen on their metabolism by the dairy cow. (Project G-39)

Show Last Drawn Milk To Be Secreted Last

Goats were milked at short intervals, with the aid of the let-down hormone, oxytocin, after radioactive calcium was administered. It was found that the first drawn milk was less radioactive, whereas the last drawn milk had a high concentration of radioactive calcium, demonstrating that the milk in the ducts and cistern of the udder is not mixed, to any appreciable extent, with the milk in the alveoli.

This was shown to be true, also, for organic substances, from studies with radioactive acetic acid and formic acid, both of which were shown to be converted into milk substances. This removes the major block in the application of specific activity-time studies to the physiology of milk secretion. That is, it is now possible to calculate the uptake of certain blood substances by measuring the radioactivity in both the blood and milk following the injection of a radioisotope. A technique is thus made available for obtaining milk substances, such as casein, lactose and fat, which are highly radioactive, for additional studies such as the nutritive value of milk substances in the diet. (Project G-48)

Citrus Pulp Worth 86% As Much As Shelled Corn

The feeding value of dried citrus pulp, a by-product of the citrus canning industry, for dairy cattle has not been well established. Growth, lactation and digestion studies are being conducted by the Dairy Department to determine the usefulness of this project. The growth rates of dairy heifers fed roughage alone, 4 pounds of citrus pulp per head per day, and 4 pounds of ground shelled corn per head per day, were compared. Heifers fed the three rations gained 0.98, 1.26, and 1.34 pounds per day. Calculations based on growth and feed consumption indicate that citrus pulp was worth about 86 percent as much as corn on an energy basis. Information from the lactation and digestion studies will be reported as soon as it is available.

(Project G-39)

Attempt to Identify Cause of Stale Flavors

Dairy Department workers have continued the attempts to isolate and identify the substances responsible for oxidized or stale flavors in milk products. It has been established that the flavor compounds are unsaturated carbonyl compounds in which the unsaturation is not conjugated with the carbonyl groups. The compounds contain between 6 and 8 carbon atoms.

(Project G-34)

Lactometer Test Checked On High, Low Butterfat Milk

The lactometer test for total solids in milk has been applied to milk in the low fat range (1.5 to 3.0 percent), and milk of high fat content (5.6 to 7.9 percent). In the low and high fat range, a total of 121 samples from ten different herds have been examined. The variation of the results obtained by the lactometer method from the gravimetric method was somewhat greater than that experienced with milk of average fat content (4.0 percent), but still showed favorable accuracy for the lactometer method. (Project G-35)

Top: Fed hay, silage and 4 lbs. of corn meal daily, eight heifers in this group averaged 1.34 lbs. of gain each day. Bottom: With 4 lbs. of citrus pulp substituted for corn, these eight heifers averaged 1.26 lbs. daily gain.

Milk Quality High After 7 Days in Farm Bulk Tanks

A long range project was initiated this past year to study the many aspects of the bulk handling of milk on dairy farms. The primary aim of this original phase of the study was to obtain information on the keeping quality of milk subjected to extended storage periods on the farm in the bulk tanks.

Two tanks, one of an ice bank or sweet water design, and the other a direct expansion unit, were included in the study. The milk stored in these tanks was analyzed four times each day for bacterial population, acidity, and flavor. The milk was maintained in the tanks at 33-35°F. In all trials, the quality of the milk was of the highest order after seven-day storage, and still acceptable but of slightly lower quality, after ten-day storage. Both tanks used in the study were equally effective in maintaining milk at this high level of bacterial and flavor quality. (Project G-44)

Isolate Pigment Causing Browning of Heated Milk

During the past year, concentration of the brown pigment in highly heated milk has been achieved. Studies are now in progress to isolate and identify the brown color components of the pigmented concentrate.

Much has been learned about the brown pigment this past year. It is extremely soluble in water and partially insoluble in all other water-free solvents. It is a rather large and complex substance with a molecular weight of approximately 10,000. Indications are that the pigment results from a heat catalyzed inter-reaction of the milk proteins and milk sugars, and that the resultant color is due to a class of compounds rather than a single chemical compound. (Project G-40)

Ice Cream Mix Pasteurized Successfully at 200-260° F.

Pasteurization temperatures of 200 to 260°F. for ice-cream mixes have been studied in comparison to the conventional holding method of 160°F. for 30 minutes.

Findings indicate that high-temperature pasteurization, 240 to 260°F., can be successfully used in the ice cream industry, and that such heat treatment has certain effects upon the properties of ice cream; namely, that the keeping properties are improved and the mix constituents are so affected that the amount of stabilizer needed is affected. (Project G-42)

Survey Sets Standards For Adulteration Test

Work in the Dairy Department has continued on the development of more sensitive methods for detecting non-milk fats in adulterated dairy products. A year's national survey of the butyric acid content of milk fat has been completed. Since milk fat is the only food fat containing butyric acid, the establishment of the normal values for the butyric acid content of milk fat will aid in the detection of adulteration. A quantitative application of the hydroxamic acid reaction for characterization of milk fat has been developed. This is a rapid color test which will be very useful in attacking the problem.

(Project G-35)

ENTOMOLOGY

Research in entomology has followed the following paths:

To improve control of insects that affect vegetable crops and especially those that are called canning crops; to develop the best timing and insecticides for hay crops, particularly alfalfa; to control insects affecting peaches and apples and at the same time produce fruit of high finish; to improve methods and machinery for the application of insecticides; to apply insecticides in such manner and amounts that there will be no off flavor or deleterious residues; to prevent injury to orchid plants and flowers, as any injury, however slight, throws an orchid off grade and makes a high cost item of the florists' trade unsalable; to prevent injuries and to control infestation on ornamentals. These are the principal efforts to help the producer, farmer or florist to grow produce that can be marketed at a profit.

Investigations of fly and mosquito problems affecting the comfort and welfare of householders and the general public have been underway. In addition, fundamental problems in taxonomy of several groups will contribute to the sum total of our scientific knowledge.

Spraying As Needed Effective In Cucumber Insect Control

Three years' work has been completed on spraying for the control of insects and diseases on cucumbers grown for slicing and for pickles.

The application of recommended high volume sprays of insecticides and fungicides consistently increased yields; in 1952, a 28 percent increase was obtained, in 1953, a 68 percent increase, and in 1954, a 40 percent increase resulted in weight of No. 1 fruit.

Treatments applied in fixed weekly schedules were no more effective than when treatments were applied as need indicated. In 1953, two early treatments with lindane (for striped cucumber beetle on newly emerged plants), followed by two applications of fungicide after first fruits began to form, with malathion (for aphid) and nutrients (borax and Nugreen), added gave as high a yield as a weekly application of insecticide and fungicide.

Lindane used in emulsion form appeared to be the safest insecticide for use on cucumbers. It should not be applied after blossoms appear. When sprayed on the fruit, detrimental off-flavors will result if stock is used for pasteurized pickle. However, no off-flavor has resulted from the use of lindane

where fruit is brined and fermented. Not over two applications of lindane should be made and often one will be sufficient. The first should be applied as soon as the first beetles attack young emerging plants; a second treatment may be made a week or ten days later if needed. If aphids occur late in the season a single malathion spray should suffice. It may be applied with a fungicide.
(Project H-29-i)

Earworm Control Results Influenced By Variety

In 1954 12 popular or promising varieties of canning sweet corn were studied to determine the effect of variety on results secured with DDT-emulsion sprays. It was found that there was little initial difference in the percentage of ears infested if all varieties silked during the same period. There was considerable difference in the reduction of the earworm infestation by two DDT-oil-emulsion treatments.

The poorest earworm control resulted on Evergreen Hybrid 3x33; the best reduction on Victory Golden, Peoria, and Hoosier Gold. On Evergreen Hybrid 3x33 the infestation was reduced from 63.5 percent in the check to only 51.6 percent in the treated plots. In Victory Golden it was reduced from 69.2 percent to 13.3 percent, in Peoria from 69.6 percent to 32.6 percent, in Hoosier Gold from 77.6 percent to 23 percent.

There was a greater difference in the sap beetle infestation between varieties and its response to two DDT-oil-emulsion sprays. Golden Cross Bantam was the most heavily infested, 89.8 percent of ears having larvae present. Two DDT treatments reduced the sap beetle infestation to only 86.1 percent. Sap beetle was controlled best on Victory Golden by two earworm sprays: 26.4 percent of ears on check plots were infested while only 2.2 percent were infested on treated plots.

Best ranking varieties from the standpoint of control of ear infesting insects were Hoosier Gold, Victory Golden, Peoria; the poorest, Iochief and Golden Cross Bantam. Studies on the response of insect control on different varieties will be continued.
(Project No. H-29-j)

Field Control Needed To Solve Gnat Problem

Studies of drosophila show that a careful and thorough sanitation program, accompanied with insecticidal control at the canning plant, is not sufficient for handling this problem late in the season. In the cool weather of early fall, heavy gnat populations build up in the field. These adult flies are constantly being carried to the canning plant on raw stock. Until effective and practical field control is developed, canners will continue to have a serious drosophila problem.

Experiments with field sprays at College Park have not given encouraging results. Applications of DDT, Lindane, and malathion did not effectively reduce field populations sufficient to relieve the problem. More work is planned on field spraying with other insecticides and fly baits. Studies of residues and effect of such sprays on flavor and quality of tomatoes will be made. (Project H-29-k)

Malathion, Dilan Effective For Bean Beetle Control

Insecticides, recommendations and equipment developed in experimental work at College Park for control of bean insects have been tested for two seasons in commercial scale operations. Both malathion and Dilan, applied at two pints of emulsifiable concentrate in 25 gallons of water per acre with Slosser type spray boom, have given even better control in large scale treatments of the Mexican bean beetle than expected from results of the experimental plot treatments.

Benefits of an adequate control program seem to be accumulative. On one commercial acreage where recommended treatments were made in 1953, the over-winter population appeared to be reduced so that fewer overwintering beetles were present in 1954. In fact, on this 65 acres not a single beetle could be found at the time the spring crop was harvested.

Since the Mexican bean beetle became prevalent in Maryland, in 1928 according to census figures, the state has never averaged more than 1.8 tons of snap beans per acre. Before the bean beetle invaded this area averages of 2 tons or more were often obtained. Adequate Mexican bean beetle control not only results in increased yields of crops but also in improved quality. Pods are not scarred by larval feeding and vines are more vigorous resulting in production of more tender fruit.

The control of bean insects removes some of the hazard of bean production justifying a complete crop improvement program. With insect control, irrigation, proper fertilization, and cultural practices, crops of 5 to 7 ton or more per acre can be produced. Such a program will result in consistent production and permit intelligent planning so that crop failures and over production may be prevented.

(Project H-29-l)

Screening tests of new insecticides in the room used during fall, winter and spring for production of milky disease spore dust for Japanese beetle control.

Insect and Disease Control Necessary in Pickle Production

In experiments at College Park two or three applications of fungicide are indicated. The first at the time when the first fruit begins to form. Treatments may be repeated every ten days to two weeks or when needed. If weather is dry less fungicide will be needed than in wet weather.

Early insecticide application may be applied with low volume row crop equipment. Use three nozzles per row, adjusted so as to concentrate the spray in a narrow band along the row. For application of fungicide, conventional high volume spray is necessary, applied with the same equipment as recommended for tomatoes.

In 1952, insecticide-fungicide dust applied weekly did not increase yields of pickles over plots receiving no treatment. In 1954, low-volume sprays applied with fan type nozzles did not give as good results as conventional sprays.

(Project No. H-29-i)

Orchid Pests Controlled With DDT Emulsion

The project known as pests of commercial floriculture has been in progress for a number of years. Since 1943, attention has been centered on control of orchid pests. In the past year the investigation of *Brevipalpus australis* and large scale treatments of Dendrobiums to control mites and a second large scale treatment of *Coelogyne cristata* for the control of the Florida red scale and the control of the long tailed mealy bug on *Phaius grandiflora.* The first two of these were in commercial establishments and the last two in the United States Botanical Gardens. The mite on Dendrobiums was eliminated, and along with it the sunken black areas that seemed to be initiated by the mite, with the use of several insecticides applied at monthly intervals, even while the plants were in full bloom. The Florida red scale was controlled on *Coelogyne* with the use of a DDT emulsion developed by the Department of Entomology. Likewise, the long tailed mealy bug was controlled with the same treatment.

(Project H-50-a)

Insect Control Increases Life of Peach Orchards

Research on the control of peach insects has resulted in some outstanding information on the control of curculio, Oriental fruit moth, peach tree borer, and catfacing insects.

Before the inauguration of this project, the peach tree borer was killing approximately one-tenth of the trees in each orchard annually, and many other trees were damaged.

A method of controlling this pest was developed at the Hancock Field Station and, at the present time, commercial growers are getting 100 percent control at a cost of approximately $4.00 per acre less than the cost in previous years.

Previous to this program, Oriental fruit moth and cat-facing insects were damaging from 25 to 35 percent of the fruit in most commercial orchards. With the use of the new spray programs developed, there is less than 1 percent of the fruit damaged by all types of insects.

It would be impossible to estimate the value of this research to the peach growers of Maryland and other peach producing areas. It is estimated that with the use of the recommended spray programs the productive life of a peach orchard today will be from 10 to 15 years longer than it was in previous years. (Project H-55)

Concentrated Sprays Show Promise on Tomatoes

The cost of spraying tomatoes may be reduced by applying the same amount of insecticide and fungicide per acre in less than the usual 150 gallons per acre. This is indicated in the results of spray experiments in 1954. Where insecticides only are applied on young tomato plants early in the season, highly effective flea beetle and potato bug control was obtained with 25 gallons of water per acre. Insecticides in emulsion form can be applied with conventional sprayers, equipped with small apperture nozzles, in 25 gallons of water per acre without danger of nozzle stoppage. Nozzles with larger openngs are necessary for application of fungicide suspensions.

Results indicate that fungicides may be effectively applied in as ittle as 40 gallons of water per acre by reducing nozzle size below hat generally used and by increasng the speed of the sprayer. Spray pressure seems to be the most important factor in getting good plant coverage and resultant good isease control. Good results were btained in these experiments with our flat spray weed-type nozzles. Commercial scale experiments are planned with this type of equipment next year.

Three varieties of tomatoes were used in these experiments in 1954, Victor, Rutgers, and Chesapeake. Unsprayed plots of Rutgers yielded 7 tons per acre of number one fruit, while unsprayed Chesapeake yielded 10 tons. The conventional spray applications results in 42 percent increase in yields of Victor, 51 percent increase of Rutgers, and only 16 percent yield increase in Chesapeake. Treated plots received weekly treatments of both insecticides and fungicide starting after the first fruit had set.

(Project H-46-d)

Endrin and TDE Tested For Tobacco Hornworm Control

Endrin and TDE emulsions were applied to tobacco with weed type sprayers in June and early July for control of the first brood hornworms. One application of both of these materials gave satisfactory control. Light infestations of green peach aphid were present on some of the plots. There was no measurable reduction of aphid populations by Endrin, which is considered to have some antiaphid properties.

Aircraft applications of TDE gave satisfactory control of second brood hornworms when applied under favorable atmospheric conditions. (Project H-40 Revised)

Corn Borer Injury Light in 1954 Season

The combination of the biological control that has been prosecuted vigorously for the past two years and the drought conditions of the summer of 1954 apparently was responsible for a major reduction in the European corn borer to the point that there was practically no injury in the state from this pest during the year. Consequently, the prosecution of more effective control measures was delayed pending a sufficient supply of borers, and sufficient activity of the insect to warrant vigorous work on this pest. The survey work on borers, and the parasites was completed as usual and these results have been sent to the cooperating agencies at Minneapolis.

(Project H-43-b)

Study Biology and Control Of Chestnut Weevils

Chinese and hybrid chestnuts on farms and suburban properties there has been a need for a more efficient control of the larvae that infest the nuts. The chestnut industry in Maryland is a small one but profitable if the nut weevils can be controlled.

The life and seasonal history has been worked out on two species of chestnut weevils, along with considerable information about larva and adult behavior. This information has led to control studies on both the mature and immature stages. The adult can be partially controlled by DDT sprays, however, the timing of these spray applications seems to be a critical factor. Excellent control of adults with 1.5 percent lindane dust has been obtained in one orchard on the Eastern Shore. Soil surface sprays to kill the larva as it enters the soil has not been successful.

Research is being continued to decrease the cost of control measures and give increased control efficiency. Also, the biology of the nut weevils that infest hickory, pecan, acorn, and filbert nuts is being worked out. (Project H-60)

Cages enclosing the entire tree are used in the study of the Chestnut weevil.

New Spray Programs Increase Yield and Quality of Apples

Recent investigations on the control of codling moth have included the testing of various combinations of insecticides and fungicides for effectiveness, compatibility and some phytotoxicity. Many of the combinations tested were found to give control of codling moth, but resulted in serious damage to fruit and foliage. It was also observed that certain combinations were giving excellent control of codling moth and were nonphytoxic. As the work was expanded, spray programs were developed that are now being used throughout the apple producing area of the East that are giving much more effective control of the pests involved than the old programs, and at the same time resulting in increased yields of the highest quality ever produced in this section of the country. Some commercial growers have doubled their yields of certain varieties of apples by the use of the new spray program and for the first time in the history of apple production in this area, a large percentage are being packed as "fancy" or "extra fancy". Records from the experimental plots, over a period of four years, have shown that the newer spray programs resulted in increased yields and higher quality fruit on all of the varieties tested. The project has also resulted in better control methods for the red-banded leaf roller, rosy apple aphid, curculio, orchard mites, and various other pests. (Project H-48)

Developing Recommendations For Ornamental Pest Control

Work has been in progress for a number of years on pests of ornamentals. In the last two years considerable work has been done upon the boxwood psyllid and pests of holly. This work is not completed but definite progress has been made and in the case of both insects we are now able to recommend control measures that are effective. Several items, such as timing in the case of the boxwood psyllid and the method of application of the preferred insecticide in the case of the holly leaf miner, need to be developed.

The boxwood psyllid disfigures the boxwood by curling the leaf clusters. The application of malathion emulsion at the rate of 1½ quarts to 100 gallon is exceedingly effective but our previous applications have not been applied early enough to prevent all curling. Applications this year will be made around the first of April rather than the last of April as heretofore.

The systemic insecticides seem to be very effective against the holly leaf miner and malathion and summer oil against the scale *Ceroplastes flocifera*, a scale that threatens to invade Maryland as it is at present doing lots of damage in Virginia.

Work is also being done upon a new scale of hemlock, *Fiominia externa*, on the boxwood leaf miner with systemic insecticides, OMPA and Systox, and on several posts of azalea particularly *Ferrisiana virgata*. (Projects H-35-a, b, & c)

HOME ECONOMICS

This project in human nutrition was conducted by the College of Home Economics.

Utilization of Protein By Normal College Women

Of food we eat probably protein foods like meat are the more expensive. When money is limited it is often this group of foods which is purchased in smaller amounts. This may endanger health for we need a given quantity of high quality protein daily. The quality of a protein food is represented mainly by the kind of amino acids it contains. The protein content of beef and fish is similar in quantity and kinds of amino acids in the portions usually eaten. In Maryland we are interested in fish as a food and as an industry.

Although the protein of beef and fish is similar, the value to the body depends on the release of the amino acids for body use. Few human experiments have been concerned with the utilization of protein from a specific source over a period of time. When small quantities of protein foods are eaten the effect of the main source of protein should be emphasized.

These thoughts were the background for a plan to study the body response to different quantities of fish and beef. The subjects were college students and the metabolic experiment was conducted at the College of Home Economics. The subjects ate a controlled diet of known chemical composition for six weeks. One group of students ate beef at their main protein food; the other group ate haddock. During the first two weeks the experimental diet was very low in protein to establish a definite body need. Then a small quantity of beef or fish was given to each of the respective groups for six days. The quantities of fish and beef were increased thereafter in step-wise manner. At the end of the experiment the portions were large. A study of the bodily response or utilization was made by comparing intake and excretion of nitrogen or protein.

The results pointed out the importance of the level of calories in nitrogen utilization. The subjects received calories to keep their body weight constant. Another experiment has been planned at a higher calorie level. The data of these experiments should point out the nutritional value of the two protein foods, beef and haddock and contribute to the knowledge of protein utilization at low levels of protein intake. (Project BJ-9, Y-1)

HORTICULTURE

The program of research work in Horticulture is designed to assist growers in more efficient production of fruit, vegetable, and ornamental plants. To accomplish this objective, research tools from many phases of plant science are employed in the laboratories and greenhouses at the University, on the experimental farms, and on the farms and orchards of cooperating growers throughout the state. Since a large proportion of the vegetable and fruit crops of Maryland are processed by canning or freezing, an important part of the research program is concerned with this phase of the horticultural industry.

Brief summaries of the more important findings in recent horticultural research are presented in the following pages. Detailed information on the projects is available in scientific journal papers, station bulletins, and popular articles released by the Experiment Station. The research laboratories, greenhouses and farms of the department are open to those interested in horticultural research. Through individual visits, through programs at the field days and laboratory workshops, and by meetings for growers and processors, research findings are presented by the research worker directly to the producer.

Compare New Varieties

Plant breeders are constantly at work developing new varieties of many crops. The testing of these varieties in comparison with the well-established varieties is an important phase of the research program.

Tomatoes: Of 20 varieties of tomatoes grown at the Vegetable Research Farm, only one breeding line, Step 197, exceeded Rutgers in total yield. Several varieties exceeded Rutgers in the yields harvested by September 1. These included W-R Brookston, Queens, Stokescross No. 4 and Stokescross No. 5.

Snap Beans: Kinggreen, Contender, Tenderlong 15, Bountiful, Sweetheart, and B-2194-1-1 yielded heavier than the standard Tendergreen in both spring and fall plantings at the Vegetable Research Farm. Seminole was promising as a variety for spring plantings.

Sweet Potatoes: Eighteen varieties of sweet potatoes were harvested in August, September, and October. Shoreland and Redgold were high in yield of U. S. No. 1 size roots. Vates Golden, Nemagold, Sunnyside and La. 0-123 were earliest in development. Thirteen varieties exhibited less cracking than did Maryland Golden.

(Project Q-74)

Irrigation Profitable With Vegetable Crops

Irrigation of vegetable crops during the dry season of 1954 resulted in greatly improved yields and better quality in research plots of the University of Maryland. At College Park, snap bean yields were increased by about two and one-half tons per acre in an early summer crop and by two tons per acre in a late summer crop as a result of irrigation. At Salisbury, irrigation increased yields of beans from approximately one and one-half tons to three and one-half tons per acre. Supplying water when needed by the crop resulted in larger pods having a more desirable shape and lower percentage of seed at harvest time. Pods also tended to be less fibrous when irrigation was provided.

When cucumbers received supplemental irrigation yields were increased from 250 to 575 bushels per acre. Shape and color of the fruits were improved with the result that a much higher percentage were graded as marketable.

(Projects Q-77 and Q-83)

Matai Found Adapted To Maryland's Eastern Shore

Matai is a water plant, producing an underground corm that has been found very desirable when incorporated with certain foods. It is extensively used in the preparation of American-Chinese foods. Trials at the Vegetable Research Farm have indicated that yields of 10 to 15 tons per acre of the marketable corms might be expected where an adequate water supply is available.

Best yields have been obtained when the corms are started in the greenhouse and are transplanted to the field as plants 12 to 18 inches in height. These transplants should be flooded with about 4 inches of water immediately after transplanting, and the water level should be maintained throughout the growing season.

Difficulties yet to be overcome include methods for the mechanical harvesting of the crop, and for mechanical peeling of the corms.

(Projects Q-74 and Q-58-n)

Growth Regulator Prevents Blossom Drop of Tomatoes

During periods of very cool weather in the spring, pollen tube growth is frequently so slow that all of the flowers of tomatoes are not properly fertilized and subsequently fall off of the plant without setting fruit.

The results of a three year study indicate that much of this blossom drop may be prevented with a spray of the growth regulator, para-chlorophen-oxyacetic acid (CIPA). Several growth regulators were used in the study but CIPA was the one considered most safe for general use. The action of this chemical in preventing blossom drop has been known for several years, but most of the patent materials on the market are of such a concentration that the spray must be directed only at the flowers. The present research indicates that at a concentration of 15 parts per million the CIPA may be sprayed over the entire plant.

The work also indicated that in many areas of Maryland there would be little use for such a material, but that in parts of the Piedmont area and in the Mountain area the production of fruit should be made considerably earlier with the use of this growth regulator. (Project Q-77)

Foliar Feeding, New Varieties Promise Improved Melon Quality

Work started in 1949 toward improving the quality of Maryland melons, so that a consistently high quality fruit could be marketed. At that time it was realized that greater control of the nutrition of the crop and the breeding of new varieties adapted to Maryland should offer a solution to the problem.

Studies with nutrient requirements have yielded the information that, although all fertilizer elements are important, the materials usually lacking were magnesium and boron. One important finding was that magnesium deficiency symptoms closely resemble the symptons of downy mildew disease, and that calcium deficiency symptoms closely resemble the symptoms of Macrosporium leaf spot. Since liming of soils is a common practice only very few instances of calcium deficiency have been observed in the field. Many of the liming materials, however, are low in magnesium and the incidence of magnesium deficiencies in commercial fields has been rather frequent. In no case has the symptoms of acute boron deficiency been observed in the field, although a response to borax applications has been relatively frequent.

Research just completed points to the spray application of magnesium sulfate and borax to the foliage as being the method most suited for quick results. Results over a six-year period at the Vegetable Research Farm at Salisbury indicate that these materials applied along with the zineb fungicide will usually insure an average of about 10.5 percent soluble solids for all melons harvested. Recommendations for the Eastern Shore of Maryland are to spray cantaloupes with zineb on a 10-day schedule throughout the season, and to add 4 lbs. magnesium sulfate and 2 lbs. borax to 100 gallons of spray, (1) when the vines begin to run, and (2) when the early fruit are 1 to 2 inches in diameter.

Breeding holds promise of new varieties developed specifically for Maryland producers within the foreseeable future. Lines have already been developed that have an average of over 14 percent soluable solids. Other lines possess, individually, such desirable characteristics as small cavity with thick meat, hard shell, resistance to defoliation and characteristic netting. Within the next few years an effort will be made to combine these factors to produce the Maryland cantaloupe of the future.

(Projects Q-79-c and Q-81)

Foliar Feeding Increases Yield, Grade of Tomatoes

Five years of spraying tomatoes at the Vegetable Research Farm with magnesium sulfate and borax have shown that the yields of tomatoes and the grade of the fruits may be improved by the foliar application of these fertilizer materials. Recommended procedure is to add 4 lbs magnesium sulfate and 2 lbs. borax per 100 gallons, along with the fungicide, when the crown set fruit begins to turn pink and again during the third week of harvest.

Yield increases observed have been only in the U. S. No. 1 grade fruit. No differences are observed in the U. S. No. 2 grade. The magnitude of the differences in yield of the higher grade are such that increases in net return of about 50 dollars should be realized from an investment of only about 50 cents for materials. (Project Q-79-e)

Potash Fertilization Affect Moisture Content Of Sweet Potatoes

In previous tests of potassium fertilizers for sweet potatoes increased yields have been obtained with potash applications up to 200 lbs. per acre. It has been noted at the same time that the moisture content of sweet potatoes receiving heavy fertilization with potash is always greater than normal. In other crops a similar increase in moisture with potash fertilization has been attributed to the chloride ion present in the potassium chloride form of fertilizer which is usually used. Comparison of the chloride and sulfate salts as sources of potassium for sweet potatoes in 1954, with varying rates of application, has shown again that the moisture content of the roots increases with potash application. This effect was obtained with both the cloride and sulfate salt, indicating that the potassium ion is responsible.

Storage behavior of the sweet potatoes did not seem to be affected by high potassium fertilization, and there were no detectable differences in the quality of the baked

Growers inspecting plots on sweet potato field day, at the Vegetable Research Farm.

sweet potatoes. The results have shown that the lower cost chloride (muriate) salt of potassium may be used for fertilization of sweet potatoes, and that, although roots of higher moisture content will be obtained with high potash fertilization, there is no accompanying loss in quality.

(Project Q-79-f)

Fertilizing Cover Crop Increases Growth and Nutrient Element Content

Tests with differential fertilizer treatments for a rye cover crop on the sandy soil of the Vegetable Research Farm has shown that fertilization will not only greatly increase the quantity of green manure produced but will also increase the mineral nutrient element content of the crop. A formulation of 10-10-10 fertilizer at the rate of 500 lbs. per acre applied in January doubled the amount of rye turned under in April and more than doubled the total nutrient element uptake by the crop. Fertilization in January was more effective than in the fall or early spring.

The use of broiler house manure at the rate of 10 tons per acre gave the greatest growth of cover and also the highest nutrient element content. The percentage of nitrogen and potassium in the rye from the manured plots was approximately twice that of the unfertilized plots, and the total uptake of these elements was about six times greater.

The amount of nitrogen and potassium in cover crops fertilized with complete fertilizers exceeded the amount applied in the fertilizer, indicating the efficiency of the cover crop in utilizing residual mineral nutrients in the soil. The amount of phosphorus in the crop, however, was only about one-third of that present in the applied fertilizer.

The results of the test point out the importance of fertilization of a rye cover crop in sandy soils to obtain greater organic matter production. The increased mineral element content of the fertilized rye cover also gives an organic residue of higher nutrient value for succeeding vegetable crops.

(Project Q-77)

Chemical Peach Thinning Tested in Orchard Trials

Peach growers throughout the nation have hand-thinned their trees annually in order to attain satisfactory fruit size at harvest time.

About 10 years ago it was discovered that peach trees could be thinned by sprays of the dinitro compounds if applied in full bloom. Maryland peach growers, however, could not use this information because of the frost hazard following the blossoming period in this area.

Following preliminary work already reported, full orchard experiments were conducted during the past year with sprays of isopropyl-N-(3-chlorophenyl) carbamate (chloro IPC) and isopropyl-N-(3 methylphenyl) carbamate (methyl IPC). Chloro IPC sprays at a concentration of 400 ppm thinned Halehaven and Elberta trees to approximately the desired level when applied a month after full bloom, while 100 and 200 ppm of the same compound failed to thin enough. Specific experiments indicated that there is a rather wide latitude in the timing of the spray; similar levels of thinning were obtained with 200 ppm of chloro IPC applied at 20, 30, and 40 days after full bloom. Within the range tested, the amount of thinning obtained was in direct proportion to the gallonage applied per tree, in the range of from 2 to 7 gallons per tree. Methyl IPC and several other carbamate compounds were tested in these experiments and found to be effective in thinning peaches, but only at somewhat higher concentrations—up to 700 ppm. More information is needed on these and other varieties before large scale commercial application of these findings is warranted.

Under the relatively cool weather conditions which prevailed during the thinning season of 1954, no difference was found between 25 and 50 ppm sprays of naphthalene acetamide for chemical thinning of apples. Timing experiments on Delicious, York, Stayman, and Jonathan, furthermore, resulted in somewhat more thinning right after full bloom than was obtained from sprays applied 12, 18, and 24 days after full bloom. An extensive experiment on Golden Delicious, however, resulted in optimum thinning from sprays applied 18 days after the full bloom, while the same concentrations applied 6 and 12 days after full bloom did not thin enough. The effect of temperature on results with the naphthalene compounds for chemical thinning of apples is being studied in current experiments.
(Project L-74-b)

Leaf Analysis Shows Fruit Tree Fertilizer Needs

Research work over the past several years has shown that the level of nutrient elements in apple and peach trees as determined by chemical analysis, is a good indication of the nutritional status of the trees. Leaf analysis surveys of Maryland orchards were conducted in 1952 and 1954. The results have shown that the nutrient levels in most of the orchards are well above the so-called critical stage. However, certain instances of very low levels were found which were associated with deficiency symptoms in the trees. Leaf analysis has also proven of value in pointing out marginal nutrient conditions, so that corrective measures may be employed before serious deficiencies develop. The results of the surveys have been made available to the individual growers with suggestions for fertilizer practices based on the findings.

The leaf analysis technique has been most successful in establishing minimum levels of nitrogen, potassium and magnesium, although other nutrient elements are being studied. Factors affecting the nutrient element level in the leaves are also under study. For example, it was found that the potassium content was much lower in leaves of peach trees bearing a heavy crop, but that the nitrogen and magnesium levels were higher. (Project Q-79-b)

Delaying Harvest Produces Better Quality Peaches

Larger peaches with better color, flavor, and storage qualities can be obtained by delaying harvest until a "firm-ripe" stage is reached.

This firm-ripe stage can be measured with a fruit pressure tester and corresponds to a reading of about nine pounds on this instrument. Redskin peaches of this maturity will attain soft eating-ripe condition in about three days when held at temperatures from 65 to 75 degrees F. Storage tests also showed that peaches picked at this stage may be held at 35 degrees F. for two to three weeks without serious loss in dessert quality.

In contrast, peaches harvested at less mature stages were of inferior quality when ripened either directly after harvest or after storage. The higher quality of the more mature fruit seems to be related to the higher sucrose and moderate acid content of these fruit. Less mature fruit tends to develop internal browning after low temperature storage to a greater extent than riper fruit.

Analytical studies of the changes taking place in the peaches after harvest showed a close relationship between firmness or pressure test readings and soluble pectin content of the fruit, with soluble pectin increasing with ripening until a pressure test of 7 to 8 pounds is reached. With further softening the soluble pectin decreased. The disappearance of chlorophyll in the fruit is also closely associated with softening, and may be used as a measure of ripening. (Project L-73)

Develop Quick Method To Determine Drained Weight

Drained weights are important to both the packer and consumer of frozen foods. The packer must achieve the proper drained weight with as little food material as possible to have a profitable operation and the consumer must get the full amount of food product to which he is entitled. Minimum drained weights are established in Federal food standards.

Up to present there has been a rather long detailed method of determining the drained weight of frozen foods. The official method sometimes takes as long as three hours to make a completed drained weight determination. The type of frozen food, either solid or loose frozen, determines the thawing time.

The new quick method developed at the University of Maryland involves defrosting frozen foods in a water bath at 140° F for 2 to 4 minutes. The solid pack leafy products such as spinach take slightly longer to thaw than materials such as peas, limas and whole kernel corn which are loose frozen.

A series of factors have been worked out for converting the quick drained weight readings to the slow or official drained weights. In all cases the drained weight values for the quick method must be multiplied by a factor smaller than 1.0 because of moisture pick-up in the quick method.

This quick conversion will be of value to packers and regulatory organizations in ascertaining drained weights of frozen foods.

(Project Q-58-j)

CaCl Dip Produces Firmer Canned Tomatoes

The canned whole tomato industry in Maryland must give the consumer a whole tomato which is firm in appearance and texture to compete successfully with packs from other areas. In the past a small amount of calcium chloride has been added directly to the can in an attempt to firm the tissues and increase drained weights.

Work during the 1954 season has shown that dipping peeled tomatoes in a 5% $CaCl_2$ solution and then canning in a .5% NaCl, .5% $CaCl_2$ or .25% NaCl, .25% $CaCl_2$ brine has increased both the firmness of the tissues and the resultant drained weight.

The addition of the calcium chloride after peeling and before canning gives the compound a chance to completely impregnate the tissues. This gives a much firmer product which is more perfectly rounded than is the case with calcium chloride added directly to the can. Such a procedure often affects only the tomato which comes in contact with the pellet of calcium chloride which is added.

Further work along these lines will be done in the 1955 growing season to completely evaluate the pre-canning addition of calcium chloride. (Project Q-58-i)

Evaluate Sweet Potato Defects for Canning

Raw sweet potato stock must be graded to insure a flow of uniform material in processing. The amount and kinds of defects have a direct effect on canning yields. The canning yield in turn can be used to establish a fair price for the sweet potatoes from the standpoint of both the grower and processor.

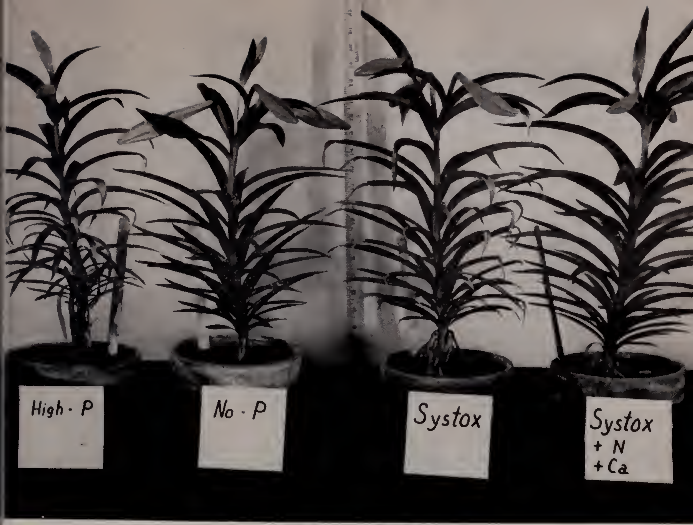
In 1953 and 1954 twenty-pound samples of sweet potato varieties commercially important in Maryland, Virginia, and New Jersey were given complete raw product inspection. The potatoes were divided into No. 1 canners and all the respective defects present such as strings, undersize, oversize, cuts and bruises misshapen, growth cracks, pitting, insect damage, black rot, soft rot, cork and cull material. Each defect was evaluated according to total weight loss, peeling loss and trimming loss.

Results show that growth cracks and cuts and bruises cause the greatest loss in canning yield. Undersize, insect damage, pitting, misshapen, black rot, soft rot, and strings, in the order named reduced canning yield to lesser extents. (Project Q-58-f)

Certain Insecticides Cause Off-Flavor of Beans

This work was initiated during the 1954 growing season to develop effective uniform methods for evaluating off-flavors which may result from the use of new chemical insecticides proposed for vegetable crops. A flavor evaluation method to select acute judges and pick off-flavored samples has been developed.

Topcrop variety snap beans were treated with malathion, lindane, BHC and dilan. The beans were given doses of pesticides to create a range of flavors from definitely off-flavor to acceptable flavor. Under certain conditions, off-flavors were detected in beans sprayed with lindane or malathion but not in those sprayed with dilan or BHC. The work will be continued to determine if normal pestcide applications will result in off-flavors. (Project Q-H-58)



Tip burn on Croft lilies is shown by the browning, dying and turning down of the tips of the leaves. Note this on the first and third plant from the left.

Find Ways to Prevent Leaf Scorch of Lilies

The Croft variety of Easter lily comonly grown in Maryland as an Easter pot plant is subject to a condition known as "leaf scorch", a type of burning at the tips of the leaves which makes the plant unsaleable. This disorder is wide spread and control measures have not always been effective.

Studies of this problem during the past two years have brought to light further evidence as to its cause and means of correction. Factors found to influence the severity of the leaf scorch are soil acidity, soil fertility and fertilizer practices. Of these, acid soil and application of phosphorus fertilizers result in excessive leaf scorch while neutral soil with high nitrogen and calcium were associated with a healthy condition of the plants. Bulbs dipped in an insecticide containing organic phosphorus were severely affected with scorch as were plants which received phosphorus fertilizer.

Corrective measures consist of planting the bulbs in a neutral or slightly acid soil and fertilizing frequently with a nitrogen fertilizer. Additional calcium applied to the soil will tend to counteract the effects of any residual or applied phosphorus in the soil. The application of lime is beneficial in two ways, in that calcium is supplied in addition to making the soil less acid. (Project I-74-a)

Study Direct Planting Rooted Carnation Cuttings

The methods of growing carnations under glass have undergone considerable change in recent years, due largely to disease problems and the need for reducing the cost of production. The practice of direct benching of rooted cuttings is generally a newer practice and is possible because of newer free branching varieties.

A study has been conducted, using four varieties: Apollo, Juno, Siren and William Sim. These were planted at 2-month intervals, beginning in November, for a total of 5 plantings. Two intervals of planting were used, a close spacing, 5 x 8 inches, and wide spacing, 8 x 8 inches, and topped or "pinched" either once or twice.

If the first crop of flowers is more valuable to the grower than the later crops, the closer planting is advisable. However, the financial returns must be enough greater in order to pay for the additional cuttings. After this first crop of flowers, the difference in production between close and wide spacing is not important. In order to obtain the heaviest flower production in December and January the rooted cuttings would be planted in May and June. Single-pinched plants produced flowers earlier than double-pinched plants. The first peak crop for single-pinched plants from November planting comes in April, from January planting in May, March planting in July, May planting in August and September, and July planting in December. Pinching twice delays the crop 4 to 8 weeks, depending upon the original date of planting and tends to reduce the total production figured for a 12-month period. Carnations benched in the winter months produced well the following winter and could be retained in production for 16 to 18 months instead of the usual 12 months. (Project I-74-b)

Test Fertilizer Needs, Soil Mixtures, for Azaleas

A three year experiment with the azalea variety, Coral Bells, has been completed where different soil mixtures were used in connection with fertilizers of different ratios of phosphorus and potassium.

Peat was satisfactory for use as a growing medium for azaleas grown in pots where the proper fertilizer was used. Little response was noted from potassium but phosphorus deficiency was very marked when this element was not included in the fertilizer.

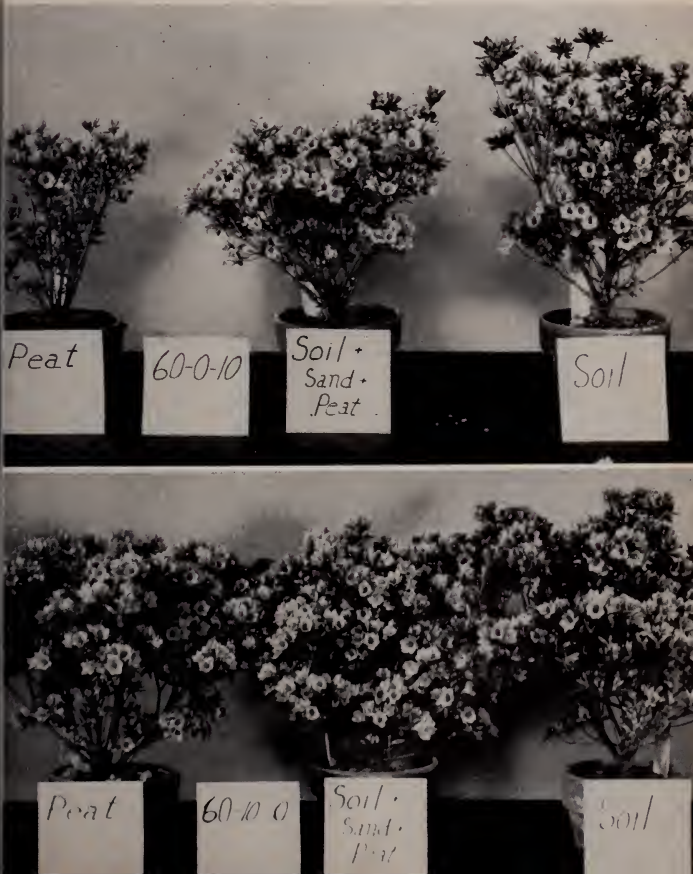
Azaleas grown in a mixture of sand, soil and peat showed considerable phosphorus deficiency when fertilized with nitrogen fertilizers alone.

When grown in a loam soil the plants showed very little phosphorus deficiency symptoms. Apparently the amount present in the soil was almost adequate for best results.

Even when grown in peat alone, the phosphorus supplied by applications of a 25-10-10 commercial fertilizer would be adequate.

A loam soil without any amendment was not satisfactory for growth of azaleas, presumably due to poor drainage. The use of a synthetic soil conditioner with this soil resulted in better water percolation and excellent plant growth. A mixture of equal parts of soil, sand and peat was satisfactory but this mixture was in no way benefited by the addition of the synthetic soil conditioner. Plants grown in peat were not as large as plants in soil. This last medium is recommended only where naturally acid soil is not available. Soil mixtures containing peat and sand are satisfactory, or if not available, the use of a synthetic soil conditioner in a loam soil should provide good growing conditions for azaleas. (Project I-74-a)

Azaleas growing in peat must be fertilized with both nitrogen and phosphorus.



POULTRY

The phenomenal rise in the importance of the poultry industry in Maryland over the past years has been in large part due to the efficiency with which poultry transforms feed into food.

Many factors are important in influencing the efficiency of the conversion, but some of the most important are the rate at which the birds grow, which in turn is influenced by the presence or absence of disease, and the diet that is fed.

Much of the research work in the poultry section is directed toward breeding improved strains of birds and improving the rations they are fed. Inasmuch as a large proportion of the feed is used for maintenance, by inducing the bird to grow more rapidly, a larger proportion of the feed can be used for growth purposes and hence improve the efficiency of the operation.

Breeding for better egg production and hatchability tend to decrease the unit cost of the chicks for broilers and to decrease the feed cost per dozen eggs produced. As with young birds, hens use most of their feed for maintenance and only a small percentage for egg production.

Development Flightless Strain of White Leghorns

Work has continued toward the development of a strain of white chickens that are flightless in nature. This flightless character is interesting in that it manifests itself only upon the growth of the second set of feathers. The wing feathers of the day-old chicks are normal. Then at eight weeks of age, when the chicks normally replace these feathers, the 22 flight feathers are not replaced, thus leaving the bird incapable of flight. A total of approximately 1000 progenies were raised this year from a total of 12 individual male breeding pens and from these 1000 birds next year's breeding stock will be selected on the basis of presence of white color, rapid growth, and the family percentages of flightless individuals.

Matings have been made between normal birds and flightless individuals as well as between parents, both of which were flightless. The percentage of flightless individuals from parents, both of which were flightless, varies markedly. Some matings produced 100 percent flightless, while others only as much as 50 percent flightless. This is taken as evidence that the gene is not recessive in nature. When flightless males were mated to White Leghorn females, a few flightless individuals resulted. This is taken as an indication that some of the major genes influencing the flightless character are dominant in nature.

Crosses between the white flightless meat-type of birds and White Leghorns has been made and a strain of flightless White Leghorns is being developed.

(Project M-33-i)

Continue Selection For New Strain of Turkeys

For the turkey to compete successfully in the present competitive meat market, it seemed necessary to develop a bird with better reproductive qualities than the currently available strains. Crosses were made between Broad Breasted Bronze individuals and Beltsville White hens and from these crosses there has been selected a strain of birds which is medium to large in size and which has superior reproductive capacities.

A total of 16 individual tom mating pens are employed, mating each tom to six to eight females. All of the eggs laid by the hens are incubated to determine fertility and hatchability. Egg production records are maintained until August 1 to get as good an evaluation as possible of the egg production performance of the hens and the fertility of the toms. This year the dams whose progeny was saved for breeders laid on the average of 95 eggs over a five-month period, with an average hatch of 80 percent of all the eggs set. Last fall at market time, the toms averaged about 20 pounds each and the hens between 11 and 12 pounds

Emphasis is being placed on high rates of egg production, fertility and hatchability in the selection program for the Maryland Medium White turkey strain.

each. These birds have been continuously bred in confinement and, therefore, should be somewhat better adapted to this type of rearing than most strains. The birds have also been selected on the basis of breast angle in order to further improve body conformation. During the current season, a limited number of birds are being made available to the turkey breeders of Maryland to determine their comparative worth under commercial conditions. (Project M-34-e)

Study Role of Hormones In Reproduction of Fowls

Some fundamental studies have been carried on to investigate the role of various hormones on reproduction and to investigate the manner whereby the sperm cells traverse the length of the oviduct to the site of fertilization near the ovary. It has been found that progesterone will inhibit the motility of the oviduct in such manner as to temporarily cause the hen to be sterile. This implies then that the activity of the oviduct is necessary to transport the sperm cells from the site of insemination to the site of fertilization and that the motility of the spermatozoa is not the main factor responsible for their migration up the oviduct. Progesterone does not inhibit the motility of the sperm cell when administered directly into the semen.

Several drugs, whose effect on reproduction have not been thoroughly investigated, are presently being employed in the poultry field for the control of pathological conditions. These drugs include nitrofurazone and furazolidone for the control of fowl typhoid, pullorum disease, and blackhead. Experiments were conducted to determine the effect of these drugs on egg production and fertility and hatchability. The results indicated that the drugs were not harmful to reproduction, but when fed to chicks, had a slight metabolic effect as evidenced by the decreased thyroid size. (Project M-33-j)

Progesterone Used To Induce Early Molt

Investigations have continued into the effect of progesterone in initiating molt. This phenomenon is of marked commercial interest in that the poultry breeders have long sought a way to cause the prospective breeders to quit laying and molt well in advance of the fall and winter breeding season. It has been observed that when 30 mg. of a slowly-absorbed form of progesterone are intramuscularly injected, the bird will immediately cease egg production and in about ten days or two weeks begin a precipitous molt. If this treatment is employed during mid-summer or early fall, the hen will go through her normal annual molt. When the treatment is administered during the early fall or winter season, the molt will be of short duration after which she returns to production. During the past season, several large commercial operators employed the technique and were quite pleased with the results.
(Project M-32-l)

Investigate Thyroid Activity And Blood Cholesterol

Two lines of New Hampshires have been developed at this Experiment Station which differ as much as five-fold in the enlargement of the thyroid glands when fed thiouracil. To measure whether or not this marked difference in thyroid response was associated with thyroid activity, the serum protein-bound iodine values for the two strains were determined. It was found, first, that the strains were not markedly different in the amount of protein-bound iodine present in the blood stream and were, therefore, assumed to have comparable thyroxine secretion rates. Second, it was found that the protein-bound iodine for the chicken was approximately 1.09 micrograms percent, whereas, the values reported for most other animals are approximately 4.5 micrograms percent.

It was decided to determine the serum cholesterol levels for chicks produced by these two strains of birds since serum cholesterol is supposed to be negatively related to thyroid activity. A mean value of 151 mg. percent was obtained, there being no significant differences between lines but a marked difference between sire and dam families. This indicates that serum cholesterol is markedly influenced by genetics and that it would be possible by selection to develop strains of birds differing in this physiological character. A significant coefficient of correlation of +.22 was found between serum cholesterol and four-week body weights. Males tended to have considerably higher serum cholesterol levels than females, up to seven weeks of age. It is intended to determine if other characteristics of economic importance are related to serum cholesterol.

(Project M-33-e)

Calorie-Protein Ratio Important

Studies with growing broilers have shown that the ratio of productive energy to the crude protein content of the ration affects feed consumption, feed efficiency, body composition, growth rate, and feather condition. The body fat content of growing broilers was increased from 18.9 to 39.4 percent on a dry basis by varying the calorie-protein ratio of the ration. If rations which are sub-optimal in protein for their energy content are fed, broilers tend to overeat in energy in an effort to compensate for the sub-optimal protein level. The additional caloric intake is deposited as body fat largely in place of body water. Under field conditions, as birds tend to overeat in order to compensate for this dietary imbalance, they tend to pull feathers. If the calorie-protein imbalance is sufficient, impaired growth also results. Caloric intake has increased as much as 17 percent by broilers during the finishing period when sub-optimal protein levels were fed. The body fat content increased approximately 80 percent without influencing the rate of growth to four weeks of age.

Studies of practical-type broiler rations with different calorie-protein ratios indicate that 1 percent of completely balanced crude protein is adequate for approximately 41 to 42 Calories of productive energy per pound of starting ration and 47 to 50 Calories of productive energy in the finishing ration. It is estimated that the efficiency of broiler rations can be improved, on the average, by approximately 2½ percent by properly balancing the levels of energy and protein. This would amount to an annual savings of approximately ten million dollars. (Project M-35-l)

Record Feed Conversion Obtained With Balanced Ration

By employing the concept of proper calorie-protein ratio, high-efficiency broiler feeds have been developed which produce three-pound broilers in seven weeks and three days with a feed conversion of 1.6 pounds of feed per pound of broiler or 4.8 pounds of total feed required to produce each three-pound broiler. This high-efficiency broiler feed was not only properly balanced with respect to protein and energy but the levels of other critical nutrients, including minerals and vitamins, were also increased in relation to the increased energy level of the ration.

In field studies involving 8000 straight-run broilers (New Hampshires and Lancaster Specials), practical rations, similarly formulated, produced broilers averaging three pounds in nine weeks with only 2.37 to 2.40 pounds of feed per pound of broiler.

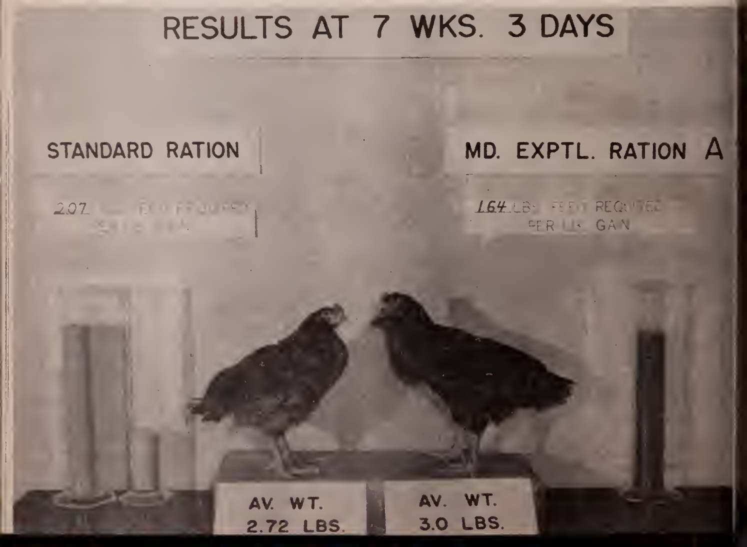
(Project M-35-l)

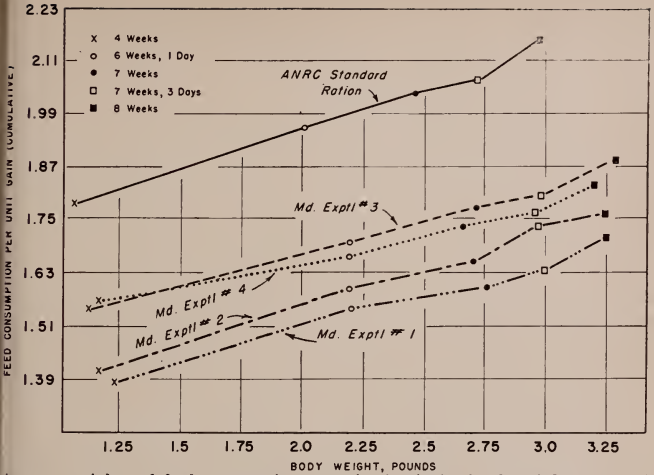
600 mg. of Choline Adequate for Broilers

In two broiler field trials, the addition of 100 mg. of choline per pound of feed to rations containing from 600 to 630 mg. of choline per pound had no appreciable effect on the growth rate, feathering, or feed efficiency. This was true even when the ration contained 4 percent added fat. It would appear, therefore, that 600 mg. of choline per pound of feed is essentially adequate for broilers.

(Project M-35-g)

Representative broilers from groups fed the ANRC standard reference ration and a Maryland experimental ration. Broilers receiving the experimental ration required only 4.8 pounds of total feed to reach 3 pound average weights at 7½ weeks.





Average weight and feed consumption per unit of gain for broilers fed the ANRC control standard reference ration and four experimental high efficiency rations.

Several New Factors Studied

Studies with chicks and poults indicate that at least three unidentified factors are required for rapid growth. These unidentified growth factors occur in mixtures in various feed supplements, including dried brewer's yeast, dried whey and dried whey products, dried corn distillers solubles, dried molasses distillers solubles, various fermentation products, feather meal, fish meal, poultry by-products meal, condensed fish solubles, liver meal, dehydrated alfalfa meal, and others. All of these products appear to contain at least one or more unidentified growth factors required by chicks and poults.

In addition, studies have shown that the ash residue from certain of these products slightly improves the growth rate of chicks fed highly purified-type rations. This suggests that an inorganic factor may be also involved. (Project M-35-g)

Method Devised to Evaluate Nutritional Worth of Feeds

A method has been devised to evaluate the relative nutritional worth of various feed ingredients for use in poultry rations. This method determines the value of protein and energy, based on the current selling price of corn and soybean meal. It also includes the value of other critical nutrients (vitamins and minerals). This evaluation permits one to approach formulation of broiler rations and other poultry rations in such a way as to minimize the total cost of the feed required to produce each unit of product. (Project M-35-l)

Broilers Tolerate 30 Percent Fat

Various levels of fat have been added to broiler rations ranging from 4 to 30 percent. When rations were adequately supplemented with other nutrients, all levels of fat were satisfactorily used by growing chicks. In order to successfully use high levels of fat, it is necessary to also include proportionately higher levels of protein, minerals, and certain vitamins in the ration. The gizzards of broiler chickens fed 30 percent fat in their ration were appreciably smaller than those of broilers which received less efficient rations containing normal levels of fat. (Project M-35-l)

Debeaking and Feathering Conditions Studied

Broilers fed rations containing too much energy in relation to the protein in the ration during the finishing period showed increasingly poorer feathering condition at market weight as the dietary imbalance was increased. Debeaking of the broiler chicks at day-old completely prevented this difficulty and had no detrimental effects on growth rate or feed efficiency. The addition of 0.5 percent salt also improved the feathering condition at market age as compared to the addition of only 0.25 percent salt in the ration. (Project M-35-l)

Methionine Requirment Studied

In studies with growing chicks, using practical and purified rations, different levels of methionine were fed at various protein levels. Results indicate that the methionine requirement is approximately 2.25 percent of the total protein in the ration. (Project M-35-i)

Fortified Feather Meal Can Support Rapid Growth

Using rations containing different levels of protein, it has been found that the protein of feather meal is available for the chick. When more than 2.7 percent protein of the ration was made up of feather-meal protein, it was necessary to add amino acids to complete the protein quality of the ration. After the amino acids methionine, lysine, tryptophane, and histidine, were added, the protein of feather meal was capable of supporting rapid growth. In practical broiler studies, 2½ percent feather meal in the ration gave good results when DL-methionine was added. Poultry by-products meal at a 5 percent level in broiler rations also gave good results. Poultry by-products meal may be used to replace meat scrap and, to some extent, fish meal in practical rations. (Project M-35-i)

High Level of Antibiotics Increases Egg Production

During a six-month period of egg production, New Hampshire hens fed a ration containing 50 gms. of chlortetracycline (aureomycin) per ton laid at the rate of 51 percent, as compared with 41.9 percent for the controls. The addition of 17 gms. of procaine penicillin and 33 gms. of streptomycin per ton in combination exerted a lesser effect, increasing the egg production level by only 2 percent during the same period. Approximately 8 percent less feed was required per dozen eggs by the hens receiving the high-level aureomycin feed. (Project M-47)

Microbiological Problems Pertaining to Nutrition

Further work here and in other laboratories has shown that the factors required by *Lactabacillus bifidus* from poults can be replaced by pantethine and a dipeptide, arginyl-leucine. However, freshly isolated poult strains and all chick strains of *L. bifidus* require calcium and an unidentified material in fish solubles or other materials (such as papaic digest of soybeans) in addition to pantethine and the peptide. This unidentified factor can be replaced partially by glucuronic or glutaric acid but not by galactose acetylglucosamine, a substance which replaces a growth requirement for human L. bifidus. Feed concentrates containing high levels of pantethine, as measured by *L. bifidus* assays, did not increase cecal counts of *L. bifidus* in chicks nor did it affect chick growth to a significant degree. However, the inclusion of lactose in the diet at 10 percent level increased the *L. bifidus* counts and depressed the growth of chicks. It remains to be determined if *L. bifidus* plays any direct part in chick growth by robbing the chick of unidentified factors. It is more probable that *L. bifidus* influences the growth of chicks and poults indirectly. Lactose probably provides a more favorable chemical environment for the growth of *L. bifidus*, which in turn crowd out other favorable intestinal bacteria, such as *E. coli* and *A. aerogenes*, known to synthesize unidentified chick growth factors.

A survey has been made of the nutritional requirements of protozoa. Protozoa may be possible tools in nutritional research on unidentified growth factors for poultry. (Project M-48)

Continue Vitamin B-12 Study

Work has continued on the study of the effect of certain analogues related to potential precursors of vitamin B_{12} on chick embroyological development. Two compounds, 2, 5-dimethylbenzimidazole and 1, 2-dichloro-4, 5-diaminobenzene, injected into the albumin of fertile eggs before incubation, at 500 micrograms per egg, caused a marked decrease in hatchability. The killing effect was most marked during the first five days of incubation. Embryos which show partial development had a high incidence of anomalies. These anomalies were generally of the lethal mutation type, such as parrot beak or deformity of the upper beak. The addition of vitamin B_{12} to the inhibitors, in doses of 1 to 250 micrograms per egg before injection, improved hatchability to some extent. However, the injection of vitamin B_{12} *per se*, resulted in some lowering of hatchability and an increase in the number of anomalies. It is possible that the benzimidazole portion of the B_{12} molecule in the high doses of B_{12} interfered with other metabolic processes. No anomalies were observed in uninjected controls or in controls injected with distilled water or acidified water. (Project M-49)

RURAL SOCIOLOGY

Findings of rural sociological research studies have usefulness in applied sociology—agricultural extension work, classroom teaching—and in furthering more definitive research in human relations. The program within this experiment station has had four emphases: studies in social organization, suburbanization, rural population, and evaluation of agricultural extension work. Findings developed in these areas have been utilized in agricultural extension teaching and programming, in undergraduate and graduate instruction, in programs of public agencies, and by research workers in rural sociology and related fields.

Establish Inventory Of Population Data

During the year an inventory of population data was established for all election districts (exclusive of Baltimore City) in Maryland. The data included characteristics on population growth, age, sex, and race for the total population and selected items—farm operator level of living, percent farm population—for the rural farm population. This inventory of information may be exploited in research design and theses analysis in future experiment station studies.

(Project S-3)

Several surveys have been conducted to determine effectiveness of extension work.

SOIL AND WATER CONSERVATION

Soil and water conservation research is conducted cooperatively between the Maryland Agricultural Experiment Station and the U.S. Department of Agriculture Soil Conservation Service.

2 Year Rotation Produces Highest Tobacco Returns

Results over a 4 year period show a gross return per acre of $818.00 for tobacco in a 2 year rotation as compared to $736.00 per acre for a 3 year rotation or $739.00 per acre for tobacco in a 1 year rotation.

The 1 year rotation consisted of annual tobacco with a rye-vetch winter cover turned late in the spring for green manure.

The 2 year rotation consisted of rye and vetch winter cover, fall seeded after tobacco and left on the ground through the second summer and winter. None of this material was removed but was disked and plowed under the spring of the tobacco year.

The 3 year rotation consisted of wheat, fall seeded after tobacco and followed by a clover and grass mixture after wheat. The wheat and hay crops were removed. Continuing studies should clarify the relative merits of the three rotations.

Rye and Vetch Cover Must be Kept Balanced

The quality of tobacco grown after a green manure from rye and vetch winter cover is related to the proportions of rye and vetch in the cover crop mixture. Too much vetch produces poor quality tobacco and too much rye can reduce the yield. Studies with rye and vetch mixtures indicate that the proportion of vetch should be between 20% and 40% of the total top weight.

In this connection, studies were made using different seeding rates and ratios of rye and vetch. The seeding ratio of rye and vetch alone does not control vegetative composition. However, it was controlled by a combination of ratio with rates of seeding. Rye seeded in excess of one bushel per acre offered competition to the growth of vetch and reduced the proportion of vetch in the vegetation at all rates of vetch seeding that were used. This work is being continued to determine the best seeding rates under different conditions.

Tobacco Planter Helps Establish Grass Waterways

Zoysia japonica is a grass that meets most of the requirements for waterways in Southern Maryland. It produces a dense turf, requires only moderate fertility, does not become a weed or require frequent mowing. The transplanting of sprigs or cut sod with a

Zoysia waterway established with a tobacco transplanter.

tobacco planter seems to be a good method for its establishment. Water applied at transplanting insures a high survival rate.

The experiment was carried out in the dry summer of 1954. The land has been plowed. Zoysia was set out with the tobacco planter or dropped by hand and foot-pressed into the soil in furrows made one foot apart with a spring-tooth harrow. The hand-planted plots then received further treatment. Some were left as checks, others were mulched with hay or asphalt emulsion or over-seeded with ryegrass. Combinations of these treatments were also tried.

Crabgrass reduced the zoysia cover on some of the plots.

In general, none of the hand planted plots produced a satisfactory stand and were wasteful of planting material because of low survival rates. On the other hand the tobacco planter, which set the sprigs firmly and supplied transplanting water, resulted in high survival and nearly complete cover after one years growth.

It takes about 2 square feet of zoysia sod to furnish transplanting material for 100 square feet of planting area when a tobacco planter is used.

Comparison of Planting Methods

Treatment	*%Stand,* 1955
No mulch	25%
Asphalt emulsion	27%
Hay mulch	42%
Ryegrass	40%
Ryegrass + mulch	27%
Ryegrass + asphalt	38%
Mulch + asphalt	15%
Mulch + asphalt + ryegrass	22%
tobacco planter, no other treatment	90%

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Department of Entomology

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Department of Horticulture

223 Carbohydrate Reserves of Asparagus Crowns. L. E. Scott. Trans. Penin. Hort. Soc. 44(5):29-34. 1954.

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Department of Poultry Husbandry

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Department of Sociology

214 The Extension Service in Cecil County Maryland. W. C. Rohrer. (Dittoed Circular) 36 pp. February, 1955.

A494 The Relationship of Family Type to Social Participation. J. F. Schmidt and W. C. Rohrer. Marriage and Family Living. (In press)

CURRENT PROJECTS

(These are projects and not publications available to the public)

Department of Agricultural Economics and Marketing

Project No.

A-18-ai Business Analysis of Southern Maryland Tobacco Farms. G. A. Stevens, A. B. Hamilton and P. E. Nystrom.

A-18-aj Farm Labor Requirements. A. B. Hamilton.

A-19-m Rural Cooperative Credit. P. R. Poffenberger, W. P. Walker, S. H. DeVault, Lester Fox and Radcliffe Roberson.

A-19-o Conservation and Economy in Rural Transportation of Persons, Supplies and Farm Commodities. W. P. Walker and F. E. Hulse.

A-19-p Factors Affecting the Cost of Certain Kinds of Insurance to Farmers. W. P. Walker, P. R. Poffenberger, F. E. Hulse and Joseph Dagher.

A-19-r Impact of Maryland Highway Improvement Program on Agriculture. P. E. Nystrom, W. P. Walker, F. E. Hulse and Joseph Dagher.

A-19-s The Maryland Tax System, with Special Reference to Farm Real Estate Assessments and School Equalization Finance. W. P. Walker and F. E. Hulse.

A-19-t Capital Requirements in Agriculture. P. R. Poffenberger and P. M. Overholtzer, Jr.

A-26-l Prices Paid by Farmers for Commodities Bought. P. R. Poffenberger, S. H. DeVault, E. S. Troelston and C. R. Twining.

A-26-ae Lowering Marketing Costs: Increasing Efficiency in the Operation of Milk Receiving, Processing and Distribution Facilities. G. M. Beal and F. R. Manson.

A-26-ah Marketing Maryland Forest Products. G. M. Beal and B. R. Robertson.

A-26-ai Marketing Wheat, Corn and Soybeans in Maryland. G. M. Beal, D. J. Burns and Earl Miller.

A-26-aj Marketing Maryland Livestock. H. D. Smith and G. M. Beal.

-26-ak	A Study of Retail Practices and Egg Quality in Baltimore. H. D. Smith, Russell Hawes, J. B. Horne and Arnold Lundquist.
-26-al	Analysis of the Development of Farmer Cooperatives. P. R. Poffenberger, P. E. Nystrom and R. J. Beiter.
-26-am	Consumer Purchases and Acceptance of Poultry Products Under Various Merchandising Practices. H. D. Smith and J. B. Horne.
-26-an	Relation of Various Livestock Marketing Methods to Producer Returns. H. D. Smith.
-26-ao	Quality and Volume Effects Upon Economies of Plant Operation in the Canning of Tomatoes, Corn and Peas in Maryland. G. M. Beal, D. J. Burns and Eugene Gogel.
-26-ap	Supplies and Utilization of Milk for Non-Fluid Uses in the Washington, D.C., Milkshed. G. M. Beal and Alfred Merker.
-26-aq	Marketing Maryland Snap Beans. G. M. Beal, S. C. Shull and Lyden O'Day.
-26-ar	Index Numbers of Prices of Fertilizer Materials. P. R. Poffenberger and C. R. Twining.
-26-as	An Economic Study of Retail and Wholesale Flower Marketing. D. J. Burns and E. G. Taylor.
-26-at	A Study of Egg Marketing in Maryland. H. D. Smith and J. B. Horne.
-32-f	Farm Tenancy and Leasing Arrangements in Maryland. L. B. Bohanan.
-32-h	Effect of Drainage Upon Crop Yields, Farming Practices and Land Utilization. L. B. Bohanan.
-32-j	Problems Associated with Farm Irrigation in Maryland. L. B. Bohanan.
-33	Financial Arrangements in the Broiler Industry. H. D. Smith and J. B. Horne.

Department of Agricultural Education

-2	How Farmers Become Established. R. A. Murray and A. M. Ahalt.
-3	Equipment Needed for Vocational Agriculture Laboratory. R. A. Murray and A. M. Ahalt.

Department of Agricultural Engineering

-11-c	Mechanization of Tobacco Production. P. N. Winn, Jr., E. W. Martin and O. E. Street.
-11-d	Tobacco Housing. R. W. Carpenter, G. J. Burkhardt, P. N. Winn, Jr., E. W. Martin and O. E. Street.
-11-e	Structures and Equipment for Tobacco Stripping. R. W. Carpenter, G. J. Burkhardt, P. N. Winn, Jr., E. W. Martin and O. E. Street.
-15	Development of Equipment and Improved Methods for Harvesting Canning Tomatoes and Bush Beans. H. J. Hofmeister, L. F. George, G. J. Burkhardt and E. W. Martin.
-16	Pneumatic Handling of Chopped Forage. R. W. Carpenter, G. J. Burkhardt, A. V. Krewatch, K. E. Felton, E. W. Martin and J. E. Foster.
-17	Drying Shelled Corn with Unheated Air in Maryland. G. J. Burkhardt, E. W. Martin and R. G. Rothgeb.
-19	Supplemental Irrigation of Selected Field and Truck Corps. G. J. Burkhardt, K. E. Felton, P. N. Winn, E. W. Martin, A. O. Kuhn, O. E. Street, C. W. Reynolds and F. C. Stark.

Department of Agronomy

-43	Soybean Culture and Varietal Improvement. R. C. Leffel, R. G. Rothgeb and G. W. Barber.
-44	Sweet Corn Improvement. R. G. Rothgeb.
-50	Improvement of Dent Corn. R. G. Rothgeb.
-56-a	Red Clover Improvement. A. M. Decker, Jr., and C. H. Liden.
-56-g	Ladino Clover Breeding. T. S. Ronningen.
-56-i	Breeding Orchard Grass for Maryland. T. S. Ronningen.
-56-j	Pastures for Beef Producton. A. M. Decker, Jr., T. S. Ronningen, A. O. Kuhn and J. E. Foster.

B-56-l	Variety and Strain Testing of Forage Legumes and Grasses in Marylan T. S. Ronningen and A. M. Decker, Jr.
B-56-m	Seedling Establishment and Management of Legumes and Grasses. A. M Decker, Jr., A. O. Kuhn and N. A. Clark.
B-56-n	Alfalfa and Alfalfa-Orchard Grass Management. A. M. Decker, Jr., an N. A. Clark.
B-56-o	Management and Fertilization of Established Grass and Grass-Legum Mixtures. A. M. Decker, Jr., and Mitchell Thompson.
B-58-c	Weed Control in Legumes. A. O. Kuhn, J. A. Meade, T. L. Bissell, T. H Schutte and W. C. Hurlburt.
B-58-d	Influence of Environmental Factors on the Effectiveness of Several Ca bamate Herbicides. J. A. Meade and A. O. Kuhn.
B-59	Means of Correcting Unfavorable Soil Conditions in Maryland Tobacc Plant Beds. O. E. Street, C. G. McKee, O. D. Morgan, Jr., and J. E McMurtrey, Jr.
B-60	Tobacco Fertilizer Rates and Placement in Relation to Plant Populatio O. E. Street, C. G. McKee and J. E. McMurtrey, Jr.
B-65	Factors Affecting Water Stability and Porosity of Soil Aggregates. E Strickling, D. Bianco, R. Thomas, R. Gifford and C. Simonson.
B-66	Wheat Improvement for Maryland. R. G. Rothgeb, J. L. Newcome J. H. Axley and H. B. Winant.
B-67	Improvement of Small Grains for Feed. R. G. Rothgeb.
B-68	Effect of Rotational Practices Involving Various Legumes on the Growt Quality and Composition of the Maryland Tobacco. O. E. Street, G. L Steffens, C. S. Britt and E. G. Nelson.
O-43	Crop Problems in Relation to Hydrologic Studies. R. G. Rothgeb, Mitchel Thompson and T. S. Ronningen.
O-45-b	A Study of the Comparative Availability of Phosphate Materials. J. H Axley and H. B. Winant.
O-48	Classification and Correlation of Maryland Soils with Special Emphasi on Morphology, Fertility and Conservation and Interdependence of thes Factors. G. A. Bourbeau.
O-51	Alfalfa Fertility Studies, J. H. Axley, H. B. Winant, J. Miller and F Stewart.
O-52	A Study of Soil Tests as an Index of Phosphate Availability to Plants J. H. Axley, H. B. Winant, J. R. Miller and H. E-Gibaly.
O-53	Effects of Soil Physical Factors on Crop Production. E. Strickling, R G. Rothgeb, J. Axley and R. E. Thomas.
O-54	Mineralogical Studies of Maryland Soils. G. A. Bourbeau, J. R. Chaves an A. O. Kuhn.

Department of Agronomy—Seed Inspection

N-7	Inspection of Seeds Sold Throughout the State. F. S. Holmes, J. L. Newcomer, M. H. Day and A. O. Kuhn.
N-8	Examination of Samples from Seeds Sold Throughout the States. F. S Holmes, Olive M. Kelk, Ellen P. Emack, Anna H. Ferguson and J. L Newcomer.
N-9	Examination of Samples Submitted to the Laboratory. F. S. Holmes Olive M. Kelk, Ellen P. Emack, Anna H. Ferguson and J. L. Newcomer.

Department of Animal Husbandry

C-14	A Study of the Productiveness of Purebred Beef Cattle in Maryland. W. W. Green, J. E. Foster and John Buric.
C-14-a	Effect of Early Weaning on the Duration of Maternal Influences in Beef Calves. W. W. Green, John Buric and J. E. Foster.
C-14-b	Type Classification as an Aid in Selection of Beef Breeding Cattle. W. W. Green, J. E. Foster and John Buric.
C-14-c	Studies on Bodily Conformation and the Correlations Between Live-Animals Measurements and the Weight and Other Characteristics of Carcasses and of Wholesale Cuts in Beef Animals. W. W. Green, F. E. White and G. L. Jessup, Jr.
C-20	The Development of Superior Lines of Swine Based on Crossbred or Purebred Foundations. W. W. Green, S. H. Fowler and J. E. Foster.

-21	The Effect of Specific Metabolites Upon Growth Rate and General Condition of Sheep. E. C. Leffel, J. E. Foster and J. C. Shaw.
-22	A Study of Rate of Gain and Feed Requirements of Duroc and Yorkshire Swine as Compared to Maryland No. 1. S. H. Fowler, M. H. Kerr, W. L. Ensor, J. E. Foster and J. R. Sperry.

Department of Animal Pathology

-46	Investigations on Brucellois of Cattle. Cornelia Cotton and Carolyn B. Swann.
-50	Anaplasmosis of Cattle. L. J. Poelma and Arnold Johnson.
-52	Newcastle Disease Investigations with Particular Reference to Vaccine Modifications and Virus Study. R. L. Reagan, A. L. Brueckner, Sue R. Cook, W. C. Day, E. C. Delaha and J. H. Porter.
-53	A Study of Rumen Fermentation and Ruminant Metabolism with Emphasis on Their Relation to Ketosis. R. B. Johnson.
-54	Infectious Bovine Mastitis: Comparison of Different Methods of Diagnosis, Treatment and Control in the Same Herd, Comparison of Costs and Returns. E. M. Sacchi, Mrs. H. O. Lineweaver and W. A. Hook.
-55	Investigations with Infectious Enterohepatitis (Blackhead) of Turkeys. H.H. M. DeVolt, Anita Holst and Adriano Gabuten.

Department of Botany

-12	The Native Plants of Maryland, Their Occurrence, Distribution and Economic Importance. R. G. Brown.
-15-b	Spontaneous and Induced Multiple Seedlings and Haploids of *Zea Mays Capsicum frutescens* and Other Economic Plants and Their Use in Plant Breeding. D. T. Morgan, Jr., R. D. Rappleye, J. E. Endrizzi and P. Price.
-16	Cytological and Genetical Studies in Ornamental and Crop Plants. D. T. Morgan, Jr., R. D. Rappleye and J. E. Endrizzi.
-86-a	The Nature and Control of Sweet Potato Diseases Occurring in Maryland, Including Studies on Significance of Microbiological Antagonism. W. F. Jeffers, C. E. Cox and J. G. Kantzes.
-91	Evaluation of Fungicides for the Control of Diseases of Vegetable Crops. C. E. Cox, H. D. Sisler, L. O. Weaver, J. G. Kantzes, H. S. Potter, N. L. Marshall, B. C. Smale, L. P. Ditman and P. E. Hochstein.
-92	Development of Antibiotic Substances for Control of Plant Pathogenic Organisms. W. F. Jeffers and H. D. Sisler.
-93	Treatment of Soil and Underground Parts of Plants for the Control of Plant Diseases. O. D. Morgan, W. R. Jenkins and W. F. Jeffers.
-94	Selection and Development of Disease Resistant Varieties of Potatoes for Use in Maryland. C. E. Cox, J. G. Kantzes, L. O. Weaver and H. S. Potter.
-95	Development of Improved Strains of Maryland Tobacco Resistant to Diseases. O. D. Morgan, O. E. Street and H. E. Heggestad.
-96	Occurrence, Distribution and Control of Plant Pathogenic Nematodes in Maryland. W. R. Jenkins, R. A. Rohde and D. P. Taylor.
K-8-c	The Role of Trace Elements in Plant Nutrition. H. D. Gauch, R. W. Krauss. W. M. Dugger, Jr., E. C. Sisler, J. E. Ambler, G. K. Harrison and J. E. Baker.

Department of Dairy Husbandry

G-34	Chemical Changes in Milk Fat as Related to the Flavor of the Milk. Mark Keeney and William Gasser.
G-35	The Analysis of Dairy Products. Mark Keeney, W. S. Arbuckle, R. Bassette and R. Robinson.
G-37	Ketosis and Parturient Paresis in Dairy Cows. J. C. Shaw, R. A. Gessert, A. C. Chung and G. H. Beck.
G-38	The Physiology of Milk Secretion. J. C. Shaw, A. C. Chung, S. Lakshmanan, G. H. Beck and T. R. Lewis.
G-39	A Study of Factors Affecting the Availability and Utilization of Nutrients in Feeds and Their Influence Upon Body Composition, Growth and Milk

Secretion. R. F. Davis, J. C. Shaw, G. H. Beck, N. S. Woodhouse, J. A. Speicher, Gordon Heuter, R. N. Doetsch, R. Q. Robinson, F. M. Sirotnak, P. Jurtshuk, Jr., J. J. McNeill and R. Gibbons.

G-40 The Influence of High Temperature Heat Treatment on Certain Physical and Chemical Properties of Milk. J. F. Mattick, M. Keeney, W. S. Arbuckle and I. D. Rifaat.

G-42 Methods of Processing and Other Factors Affecting the Quality of Ice Cream. W. S. Arbuckle and D. J. Seeley.

G-43 The Metabolism of Acetate, B-hydroxybutyric Acid, Glucose and Other Carbon Compounds in Lactating Ruminants. J. C. Shaw, S. Lakshmanan and T. R. Lewis.

G-44 The Effect of the Farm Holding Tank Milk Procurement System Upon the Keeping Quality of Market Milk. J. F. Mattick and W. S. Arbuckle.

G-47 Nutritive Evaluation of Forages. R. F. Davis, G. H. Beck, and A. M. Decker.

G-45 A Study of the Causes and Prevention of Bloat in Ruminants. (Cooperation with Animal Husbandry Department) J. C. Shaw, D. R. Jacobson, E. C. Leffel, R. N. Doetsch, J. J. McNeill, R. J. Gibbons and P. Jurtshuk, Jr.

Department of Entomology

H-29-i The Relation of Control of Cucumber Insects to Yield of Quality Pickles. L. P. Ditman, C. E. Cox and F. C. Stark.

H-29-j Chemical Control of the Corn Earworm. L. P. Ditman.

H-29-k The Drosophila Problem in the Canning of Tomatoes. L. P. Ditman and and W. E. Bickley.

H-29-l Chemical Control of Bean Insects: Evaluation of Commercial Treatments and Investigations of New Insecticides. L. P. Ditman.

H-35-a Nursery Insects. The Euonymus Scale. E. N. Cory and H. A. Highland.

H-35-b Nursery Insects. Control of the Boxwood Psyllid Psylla Buxi(L). E. N. Cory and H. A. Highland.

H-35-c Nursery Insects. Pests of Holly. E. N. Cory and H. A. Highland.

H-40 Biology and Control of Tobacco Insects. Sub. 1. The Tobacco Horn Worm. H. S. McConnell.

H-43 Biology and Control of the European Corn Borer. E. N. Cory, G. S. Langford and H. S. McConnell.

H-46-c Liquefied Gas Propelled Sprays for the Home Gardner. L. P. Ditman and H. B. Owens.

H-46-d Studies on the Efficiency of Fixed Boom Low Volume Sprayers. L. P. Ditman, G. J. Burkhardt and F. P. Harrison.

H-48 Control of the Codling Moth. E. N. Cory and Castillo Graham.

H-50 The Biology and Control of the Pests of Commercial Floriculture. The Control of Orchid Pests. E. N. Cory.

H-55 Control of Peach Insects. E. N. Cory and Castillo Graham.

H-56 Patuxent Project on the Effect of Soil Conservation Upon Insect Populations. L. P. Ditman, H. B. Owens and E. N. Cory.

H-58 A Taxonomic Study of the Coccid genus Toumeyella and Some Closely Related Genera. H. S. McConnell.

H-59 Bionomics of Some Freshwater *Aedes* Mosquitoes in Maryland. W. E. Bickley.

H-60 Biology and Control of Nut Weevils. W. T. Johnson and E. N. Cory.

H-61 The Biology and Distribution of Macropsis Trimaculata Fitch. Castillo Graham.

H-62 Alfalfa Weevil: Life and Seasonal History, Ecology and Control. E. N. Cory and H. L. Dozier.

H-63 Ecological Studies of Mosquitoes in Freshwater Impoundments in Maryland. W. E. Bickley.

Department of Home Economics

Y-1 The Utilization of Protein by Normal College Women. Pela Brauscher, H. W. Wilson, Virginia Dawson, Pauline Anderson, Helen Snyder and students.

Department of Horticulture

-74-a	Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Hydrangeas and Azaleas. J. B. Shanks and C. B. Link.
-74-b	Effect of Environmental Factors and Cultural Practices on the Growth and Flowering of Greenhouse Cut Flower Crops. C. B. Link and J. B. Shanks.
-79-h	The Relationship of the Mineral Nutrients and of Nutrient Levels to the Growth and Flowering of the Azalea Under Greenhouse Conditions. C. B. Link and J. B. Shanks.
-79-i	The Balance and Intensity of Inorganic Nutrient Elements as they Affect the Growth, Flowering and Quality of *Hydrangea Macrophylla* Thumb. Under Greenhouse Conditions. J. B. Shanks and C. B. Link.
-73	Adaptation of Fruit Varieties and New Seedlings to Maryland. I. C. Haut, A. H. Thompson, B. L. Rogers and F. J. Lawrence.
-74	Environmental Factors and Cultural Practices in Relation to the Growth and Fruiting Responses of Fruits. A. H. Thompson, L. E. Scott, F. J. Lawrence, B. L. Rogers, S. H. Todd and I. C. Haut.
-74-b	Chemical Thinning of Apples and Peaches. A. H. Thompson, E. A. Stahly and B. D. Rogers.
-79-a	Mineral Nutrition of the Strawberry with Particular Reference to Effects of Calcium, Potassium and Magnesium on Growth and Fruiting. L. E. Scott, I. C. Haut, Ralph Ruppenthal and Virginia France.
-58-f	Develop Objective and Easily Applied Measures of Quality Factors Involved in Market Grades and Standards. A. Kornetsky, A. Kramer, L. E. Scott, R. C. Wiley, E. Sokoloff, H. S. Todd, N. Elehwani, B. N. Twigg, L. Martin and W. W. Anderson.
-58-i	Improvement of Quality of Processed Tomatoes and Tomato Products. A A. Kattan, S. H. Todd, A. Kramer, F. C. Stark, D. Abe, R. C. Wiley, and E. Sokoloff.
-58-j	Suitability of Various Materials for Use as Containers for Frozen Vegetables. A. Kramer, L. E. Scott, R. C. Wiley and E. Sokoloff.
-58-k	Development for Specifications for Canned Food Quality. R. C. Wiley, M. Modery, J. Zaric and D. Abe.
-58-n	Suitability of New Varieties of Horticultural Crops for Canning and Freezing. B. A. Twigg, W. A. Matthews, H. S. Todd, F. C. Stark, A. Kramer, L. E. Scott and R. C. Wiley.
-74	A Study of Regional Adaptation of Certain Vegetable Crops and Varieties in Maryland. F. C. Stark, A. A. Duncan, W. A. Matthews, B. A. Twigg and A. Kramer.
-77	Crop Management Studies with Vegetable Crops. F. C. Stark, C. W. Reynolds, W. A. Matthews and W. L. Hollis.
-79-b	The Mineral Levels and Interrelationships of Mineral Nutrients in Fruit Plantings in Maryland. L. E. Scott, A. H. Thompson, John Popenoe, Virginia France and Ruth Marlowe.
-79-c	Influence of Nutrient Intensity and Balance on the Quality and Physiological Defoliation of Cantaloupes. F. C. Stark, W. A. Matthews and C. W. Reynolds.
-79-d	Casual Factors and Control of "Dieback" of Asparagus. L. E. Scott and Virginia France.
-79-e	Influence of Nutrient Intensity and Balance Upon the Yield and Quality of Tomatoes. F. C. Stark, A. A. El-Kattan, A. Kramer, W. A. Matthews, C. W. Reynolds and S. H. Todd.
-79-f	Mineral Nutrition of the Sweet Potato with Special Reference to Cation Interrelationships. L. E. Scott, A. A. Duncan, F. C. Stark and Ruth Marlowe.
-81	Cantaloupe Breeding and Selection with Particular Reference to Quality and Resistance to Defoliation. F. C. Stark.
-82	Tomato Breeding and Selection with Particular Reference to Greater Resistance to Cracking and to Late Blight. F. C. Stark.
H-58-o	Evaluation of Possible Off-Flavors Resulting from the Application of Chemicals on Soils and Growing Crops. (In cooperation with Entomology). L. P. Ditman, R. C. Wiley, A. A. El-Kattan, F. Harrison, H. S. Todd and M. Modery.

BOQR-83 Engineering, Soil and Plant Aspects of Supplemental Irrigation. (In cooperation with Agronomy and Agricultural Engineering Departments) J. H. Axley, A. O. Kuhn, H. B. Winant, G. J. Burkhardt, K. E. Felton, P N. Winn, E. W. Martin, C. W. Reynolds and F. C. Stark.

Department of Poultry Husbandry

M-32-l Studies of Factors Influencing or Controlling the On-Set of Molt. C. S. Shaffner and Paul Harris.

M-33-e Differences in Thyroid Activity as Related to Strain Differences in Growth, Feed Utilization and Feathering. C. S. Shaffner and Harvey Bumgardner.

M-33-h Hormonal Control of Economic Traits in Poultry. C. S. Shaffner, D. W. Francis, P. D. Bogdonoff, A. Gabuten, M. H. Conner, H. W. Garren, A. C. Akpinar and A. Campos.

M-33-i Development of a Flightless Strain of New Hampshire Chickens. C. S. Shaffner and M. A. Jull.

M-33-j Fertility Studies with Chickens and Turkeys. C. S. Shaffner, Howard Opal and D. W. Francis.

M-34-e Selective Breeding of Medium Sized Turkeys for Improvement of Economic Qualities. C. S. Shaffner and M. A. Jull.

M-35-g The Requirement of the Growing Chick for Newer Members of the Vitamin D Complex. G. F. Combs, W. C. Supplee, G. B. Sweet and G. L. Romoser.

M-35-i Amino Acids in Poultry Nutrition. G. L. Romoser, P. F. Twining, E. J. Robel, W. E. Donaldson and G. F. Combs.

M-35-k Unidentified Growth Factors for Chickens and Bacteria. Mary Shorb, G. L. Romoser, R. W. Bishop, May L. Hansen, Dorothy D. Sowter and graduate students.

M-35-l Development of Improved Rations and Feeding Methods for Broiler Production. G. F. Combs, W. E. Donaldson, G. L. Romoser, J. L. Nicholson and W. C. Supplee.

M-45 New Studies on the Causative Effects of Wheat in Pullet Disease. G. D. Quigley and H. M. DeVolt.

M-47 Antibiotics, Arsenicals and Related Compounds in Poultry Nutrition. G. L. Romoser and G. F. Combs.

Department of Sociology

S-3 Studies in the Population of Maryland. H. H. Hoffsommer, W. C. Rohrer and Barbara Anderson.

S-3-l Population Change in Maryland and in the Northeast. H. H. Hoffsommer, W. C. Rohrer and F. D. Laws.

S-4 Studies in Social Organization with Application to the Maryland Agricultural Extension Service. H. H. Hoffsommer, W. C. Rohrer and K. L. Coombs.

TATION STAFF

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D. W. Dickson, B.S., Asst. Prof. and Pubs. Editor

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Castillo Graham, Ph.D., Assoc. Prof. Ent.
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A. H. Thompson, Ph.D., Prof. of Pomol.
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W. C. Supple, Ph.D., Res. Asst. Poultry Nut.

SEED INSPECTION

J. L. Newcomer, M.S., Asst. Prof. Seed Program

SOCIOLOGY

W. C. Rohrer, M.S., Asst. Prof.

CHANGES IN PERSONNEL

POINTMENTS

W. Dickson, B.S., Assistant Professor, Editorial, July 1, 1954
E. Felton, B.S., Research Assistant Professor, Agricultural Engineering, November 22, 1954
L. Hollis, M.S., Instructor, Horticulture, February 1, 1955
R. Jenkins, Ph.D., Instructor, Botany, August 1, 1954
W. Krauss, Ph.D., Assistant Professor, Botany, March 1, 1955
S. Potter, M.S., Instructor, Botany, February 1, 1955
W. Santelmann, Ph.D., Assistant Professor, Agronomy, October 1, 1954
C. Supple, Ph.D., Research Assistant, Poultry, December 1, 1954

SIGNATIONS

L. Bruce, M.S., Assistant Professor, Editorial, July 1, 1954
M. Dugger, Ph.D., Assistant Professor, Botany, February 28, 1955
A. ElKattan, Ph.D., Assistant Professor, Horticulture, February 15, 1955
J. Hofmeister, B.S., Assistant Professor, Agricultural Engineering, January 31, 1955
E. Hulse, M.S., Research Assistant, Agricultural Economics, February 28, 1955
H. Liden, M.S., Assistant Professor, Agronomy, October 1, 1954

FINANCIAL STATEMENT—July 1, 1954 to June 30, 1955

FEDERAL FUNDS

	Hatch	Adams	Purnell	Bankhead-Jones				
				Sec. 5	9b-1-9b-2	9b3	Title II	For Agr. Investigations*
	$	$	$ .12	$	$	$	$ 8.46	
Appropriation 1954-55	15,000.00	15,000.00	59,999.88	36,488.62	106,679.77	39.040.00	16,500.00	
TOTALS	15,000.00	15,000.00	60,000.00	36,488.62	106,679.77	39.040.00	16,508.46	
Receipts from sources other than Federal 1954-55								
State Appropriations for Agricultural Investigations								$464,847.23
Foundations and Industrial Grants								123,197.73
Sales and Miscellaneous								136,642.06
								$724,687.02
Balance brought forward July 1, 1954								95,195.71
TOTAL								819,882.73
Expenditures:								
Personal Services	9,020.00	12,200.00	46,824.47	27,665.00	55,583.95	17,712.71	10,815.62	441,234.21
Travel	2,049.80	144.62	2,473.87	788.62	5,293.27	2,978.95	3,463.12	14,759.73
Transportation	3.15	35.40	41.66	53.20	128.23	108.46		1,293.37
Communication Service	47.44		99.68	13.68	126.19	84.80		2,534.79
Rents & Utility Services	236.41		85.37	45.22	166.31	175.25		6,430.51
Printing & Reproduction	894.10		1,140.32	42.23	703.64	447.37	405.68	4,726.62
Other Contractual Services	71.24	68.05	772.86	186.83	1,673.64	2,351.08		38,011.73
Supplies and Materials	1,379.14	2,056.77	6,111.96	6,549.92	22,221.38	8,208.32	10.12	130,711.57
Equipment	748.64	495.16	2,449.81	1,143.92	19,667.25	4,806.96	358.50	50,074.15
Lands and Structures	80.85				1,115.91			15,742.51
Contrib. to Retirement								
	$14,530.77	$15,000.00	$60,000.00	$36,488.62	$106,679.77	$36,873.90	$15,053.05	$705,519.19
Balance June 30, 1955	469.23					2,166.10	1,455.41	114,363.54
TOTALS	15,000.00	15,000.00	60,000.00	36,488.62	106,679.77	39,040.00	16,508.46	819,882.73

*Including Bankhead-Jones Offset Funds.

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